

해외출장보고서
2018.4 .11
~2018. 4 .13 .
중국/ /

정책연구 네트워크 구축 및 운영을 위한 세미나 발표 및 회의

2018. 7. 11

신위뢰(기업제도연구실, 부연구위원)

I. 출장개요

1. 출 장 자 : 신위뢰
2. 출장기간 : 2018. 4.11 .(수) ~ 2018.4 .13.(금) (2 박 3일)
3. 출 장 지 : (중국/샤먼)
4. 출장목적 : 미시 경제 이론 세미나 발표 및 미팅

II. 세부일정

일자 (요일)	장소	시간	주요 일정 (방문기관, 면담자 등)
4/11	샤먼		인천공항-> 샤먼 이동
			세미나 준비
4/12	샤먼	10:00- 11:30	샤먼대학교 교수 면담: Prof. Yun Wang, Yang Yue, Kai Li
		2:30 -4:00	샤먼대학교 교수 면담: Prof. Zhi Li, Inkee Jang, Mengling Li
		4:40-6	세미나 발표
4/13	인천		샤먼-> 인천공항 이동
			*맨 뒷면에 Itinerary 파일 첨부

III. 출장 수행내용

1. 세미나 발표

- 슬라이드 파일 첨부(맨 뒷면)

2. 미시경제학자와의 미팅

- 메커니즘 디자인 이론 및 기타 미시경제학 연구 토론
 - 정책 연구를 위한 메커니즘 디자인의 응용
 - 메커니즘 디자인 연구와 정책 연구의 조화에 대한 논의
 - 메커니즘 디자인 모델에서 도출한 direct mechanism이 실제 사회에서 어떻게 실질적으로 indirect mechanism으로 변형되어 작용할 수 있을지에 대한 논의

IV. 출장의 성과(또는 시사점)

1. 연구원 홍보 및 네트워크 구축

- 산업연구원의 연구성과 소개 및 연구 네트워크 구축

2. 이론적 정책연구에 대한 논의 진행

- 최근의 미시경제이론 발전이 정책에 기여할 수 있는 부분에 대해 상호 의견 교환

V. 참고자료

※ 발표자료, 행사관련 자료 뒷면에 첨부

Itinerary for Dr. Wiroy Shin's Visit to Xiamen
(April 11–13, 2018)

April 11, Wednesday

12:30pm Airport Pick-up Flight Info.: (KE887) 10:20am-12:30pm
Pick up: Ouyang Wang cell: 19177862404

12:50pm Check-in at Yifu Building

April 12, Thursday

9:45am Pick up to Econ Building (the lobby of hotel)
Individual talks with faculty at D407 Econ Building
10:00am-10:30am Prof. Yun Wang (王云)

10:00am-11:30am 10:30am-11:00am Prof. Yang Yue (岳阳)
11:00am-11:30am Prof. Kai Li (李锴)

11:30am-1:00pm Lunch with WISE faculty

1:00pm-2:30pm Have a rest in office (D407)
Individual talks with faculty at D407 Econ Building
2:30pm-3:00pm Prof. Zhi Li (李智)

2:30pm-4:00pm 3:00pm-3:30pm Prof. Inkee Jang
3:30pm-4:00pm Prof. Mengling Li (李梦玲)

Seminar(N302 Econ Building)
Title: Discrimination in Organizations: Optimal Contracts and Regulation
Host: Prof. Inkee Jang

4:40pm-6:00pm

6:15pm Dinner with WISE faculty

8:00pm Back to hotel

April 13, Friday

11:00am Airport Drop-Off Flight Info.: (KE888) 1:30pm-5:45pm
the lobby of hotel

Other Information:

WISE website (faculty): <http://www.wise.xmu.edu.cn/people/faculty>

SOE website (faculty): <http://soe.xmu.edu.cn/faculty/>

Discrimination in Organizations: Optimal Contracts and Regulation

Wiroy Shin

Korea Institute for Industrial Economics and Trade

WISE, Xiamen University

April 2018

Examples of Discrimination

- ▶ Eliminating employment discrimination has been a high-priority policy goal in the U.S. for 50 years.
 - Civil Rights Act of 1964

Discrimination Lawsuits in the U.S.

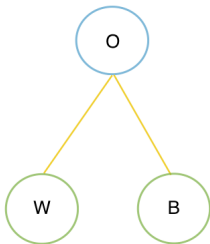
- ▶ Coca-Cola (2000) No.58 in Fortune 500
 - Racial discrimination - \$192 million (settlement cost)
- ▶ Bank of America (2013) No.21 in Fortune 500
 - Gender discrimination - \$39 million

Discrimination in Korea

- ▶ *Siegel(HBS):“ideal environment for gender arbitrage”*
 - Profiting from sexism, The Economist, Oct 2010.

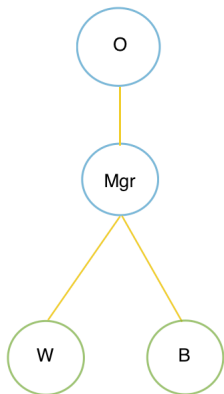
This paper diagnoses the phenomenon and proposes contractual and regulatory solutions to ameliorate the situation.

Discrimination in Organizations



- ▶ Existing economic models of discrimination
 - **Becker (1957)**, Coate and Loury (1993), Peski and Szentes (2013)
 - Models for a sole proprietorship with production workers (two level hierarchy)
 - Baseline models for small organizations

Discrimination in Organizations



- ▶ The owner delegates to the manager
- ▶ Information gap between the owner and the manager: productivity of workers, the manager's type (fair or discriminatory?)
- ▶ **Discrimination arises from an Agency problem** — This can't be analyzed by the two-level hierarchy model.

Contribution of this paper

1. The first paper studying discrimination in hierarchical organizations – what can be done inside and outside of the organizations to ameliorate the situation?
 - a. How can the manager be controlled by contractual arrangements? – Gap Projection Mechanism
 - b. Does the optimal contract achieve the first-best (complete fairness and efficiency)? – No
 - c. If not, can regulations help? - Yes, but badly designed regulation could be counter-productive .

Related Literature

- ▶ Taste-based discrimination: Becker (1957), Stiglitz (1973)
- ▶ Statistical discrimination: Phelps (1972), Coate and Loury (1993)
- ▶ Winter (2004), Peski and Szentes (2013)

Contribution of this paper

2. Distinct features of the screening problem and the solution

- ▶ Multidimensional decisions and private information
- ▶ Sequential and partial information revelation to principal
- ▶ No information-aggregation
- ▶ Existence of tractable solutions

Related Literature

- ▶ Rochet and Stole (2003)
- ▶ Courty and Li (2000), Kräbmer and Strausz (2015), Hart et al. (2015)
- ▶ Armstrong (1996), Biais et al. (2000)

Revelation Principle

How to solve?

- ▶ Direct mechanism (Myerson, 1981) - The manager reports his private information to the owner, and the owner decides rules: whom to promote $Q(\cdot)$ and a payment level of the manager $P(\cdot)$.

Applications

- ▶ favoritism in public procurement, resource allocations to subordinate institutions, corporate governance

Plan of this talk

- ▶ Part 1
Optimal mechanisms in laissez-faire environment
Analysis on regulation
- ▶ Part 2
Legal status of the optimal mechanism and its
implementation

Model

Timeline

1. The owner specifies a contract: $\langle Q, P \rangle$.
2. The manager (but not the owner) knows his own discriminatory preference type θ , and observes each worker i 's productivity: x_B, x_W .
3. The manager reports this productivity information z_B, z_W to the owner including information regarding his personal discriminatory preference on the workers t .
4. The owner promotes one worker $Q(t, z_B, z_W)$ and observes the output (perfectly correlated with the productivity) of the promoted worker $x_{Q(t,z)}$. However, she remains ignorant about the worker who was not promoted and the type of the manager.
5. The owner compensates the manager according to the contract: $P(t, z_B, z_W; x_{Q(t,z)}) \in [0, x_{Q(t,z)}]$

Assumptions

Productivity

- ▶ x_i , is i.i.d drawn from $X_\ell = [0, \bar{\zeta}] \sim f_\ell$ (pdf)
- ▶ $x = (x_B, x_W) \sim f$ (pdf), μ (measure)

Discrimination coefficient

If the manager is discriminatory, and the promoted worker's identity is B , the manager earns disutility equivalent to d .

- ▶ $\theta \in \{0, d\} \sim \nu$ (pmf)

No outside options

The owner cannot fire the manager nor can the manager refuse to provide the reports about θ and x .

Utility

Owner's profit

$\pi(t, z; x) = x_{Q(t,z)} - P(\xi_Q(t, z; x))$: outcome – payment

Manager's utility

$u(t, z; \theta, x) = P(\xi_Q(t, z; x)) - d \cdot \mathbb{1}_{Q(t,z)=B} \cdot \mathbb{1}_{\theta=d}$
: payment – discrimination coefficient

Incentive Compatibility condition

The manager cannot achieve higher utility by lying about the workers' productivity levels and his discrimination type.

$\forall \theta, t \in \Theta$ and $\forall x, z \in X$,

$$P(\xi_Q(\theta, x; x)) - d \cdot \mathbb{1}_{Q(\theta,x)=B} \cdot \mathbb{1}_{\theta=d} \geq P(\xi_Q(t, z; x)) - d \cdot \mathbb{1}_{Q(t,z)=B} \cdot \mathbb{1}_{\theta=d}$$

The owner's optimization problem

The owner's optimization problem is choosing the optimal Q and P to **maximize the expected profit**, subject to the **incentive compatibility constraint**. That is,

$$\max_{Q,P} \sum_{\theta \in \Theta} \int_{x \in X} \nu(\theta) \cdot f(x) \cdot \pi(\theta, x; x) dx$$

$$\text{s.t.} \quad u(\theta, x; \theta, x) \geq u(t, z; \theta, x) \quad \forall \theta, t \in \Theta \text{ and } \forall x, z \in X.$$

Profit-max Mechanism
when the manager's discriminatory
characteristic is known by the owner
 $\nu(d) = 1$

▶ Incomplete info

One-type case on the manager's personal type

The study on the one-type case helps to understand the two-types case in two ways:

1. It provides necessary conditions for the optimal mechanism of the two-types case
2. The optimal mechanism of the one-type case can be a simple alternative improving the status quo of the two-types case.

Full information(first-best) allocation

Suppose that no information gap exists between the manager and the owner. The manager must report $z = x$. Then, The owner doesn't need to pay any information rent to the manager and she can promote whoever has higher productivity.

$$\begin{aligned} Q^F(z) &= B, & \text{if } x_B > x_W \\ Q^F(z) &= W, & \text{if } x_B < x_W \end{aligned}$$

$$P^F(\xi_Q(z, x)) = 0.$$

Full information allocation

Expected profit

$$E[\pi(\cdot; Q^F, P^F)] = E(\max\{x_B, x_W\})$$

Probability of B 's promotion

$$\text{pr}(x_B > x_W) = \frac{1}{2}$$

Unconditional mechanism

$$\begin{aligned} \forall z \text{ and } \forall \xi_Q(z, x), \quad Q^\lambda(z) &= B \quad \text{with probability } \lambda \\ Q^\lambda(z) &= W \quad \text{with probability } 1 - \lambda, \text{ and} \\ P^\lambda(\xi_Q(z, x)) &= 0. \end{aligned}$$

- ▶ $E[\pi(\cdot; Q^\lambda, P^\lambda)] = \lambda \cdot E(x_B) + (1 - \lambda) \cdot E(x_W) = E(x_i)$
- ▶ Any unconditional mechanism is incentive compatible.
- ▶ $\langle Q^\lambda, P^\lambda \rangle$ with $\lambda = 0$ represents the status quo, where the owner does not provide any incentive, and the manager always promotes W .

Profit-max mechanism

Detectable Lie

An owner's informational state $\xi_Q(z, x) = (z_B, z_W, x_{Q(z)})$ is a **detectable lie** if $x_{Q(z)} \neq z_{Q(z)}$.

Suppose that the manager reports $(z_B = 0.5, z_W = 0.7)$ when $(x_B = 0.9, x_W = 0.4)$, and the owner promotes W . After promotion, the owner realizes an output $x_{Q(z)} = 0.4 \neq z_W$. In this case, the lie is detected.

Profit-max mechanism

Lemma 2

WLOG, the optimal mechanism punishes the detectable lie by giving the minimum level of compensation to the manager.

Lemma 3

If two reports (one true and one false) produce the same outcome, then a payment scheme should treat them equally in a set of incentive compatible mechanisms.

Profit-max mechanism

Lemma 4

If some available deviation leads to W to be promoted, in order to select B , the owner must at least compensate the manager as much as the discrimination coefficient d .

Lemma 5

Except the detectable lies, the optimal payment rule depends only on the identity of the promoted worker, not on the performance of the worker.

Profit-max mechanism

Theorem 1 - the owner's profit max mechanism

Profit maximization subject to the owner's limited information, and to the manager's incentive compatibility constraints, is achieved by the following arrangement.

1. If the manager reports a productivity gap ($z_B - z_w$) exceeds d , then the owner promotes B .
2. If the owner observes productivity different to what the manager promised, then she pays the manager 0 (detectable lie).
3. Otherwise,
If the owner promotes B , she pays d to the manager.
if the owner promotes W , she pays 0 to the manager.

Profit-max Mechanism

Expected profit

$$\begin{aligned} E[\pi(\cdot; Q^*, P^*)] &= E(\max\{x_W, x_B - d\}) \\ &> E(x_W) = E[\pi(\cdot; Q^{\lambda=0}, P^{\lambda=0})] \end{aligned}$$

Probability of B 's promotion

$$0 < \text{pr}(x_B - x_W > d) < \frac{1}{2}$$

Linear outcome-based contracts - are not maximizing profit

Outcome-based contract?

- ▶ Middle manager receives αx_i , $\alpha < 1$.
- ▶ The manager only chooses B if $\alpha \cdot (x_B - x_W) > d$.
- ▶ $x_B - x_W > d/\alpha > d$
- ▶ Comparing to the profit-max mechanism, the expected outcome is lower (more frequently, the qualified B is not promoted), and payment to the manager is higher (in any case, αx_i is given, instead of the fixed d for B 's promotion).

Profit-max mechanism
when the manager's discriminatory preference is
private information
 $\nu(d) \in (0,1)$

Unconditional mechanism when W is always promoted ($\lambda = 0$)

A mechanism $\langle Q^\lambda, P^\lambda \rangle$ is an **unconditional mechanism**, if it promotes B with probability $\lambda \in [0, 1]$ and pays zero to the manager regardless of the manager's reports and the owner's information state.

	$i = B$	$i = W$
$t = 0$	$(\emptyset, 0)$	$([0, 1] \times [0, 1], 0)$
$t = d$	$(\emptyset, 0)$	$([0, 1] \times [0, 1], 0)$

Table: Allocation rule and Payment

Unconditional mechanism is incentive compatible.

Delegation Mechanism

The manager always promotes W if he is discriminatory. If he is not discriminatory, the manager follows the first-best allocation rule.

	$i = B$	$i = W$
$t = 0$	$(z_B > z_W, 0)$	$(z_B < z_W, 0)$
$t = d$	$(\emptyset, 0)$	$([0, 1] \times [0, 1], 0)$

Table: Allocation rule and Payment

Delegation mechanism is incentive compatible.

Projection Mechanism: B-bar projection mechanism

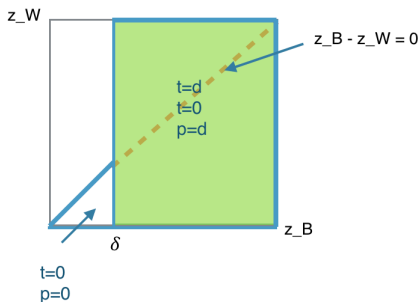


Figure: Productivity Region for
 B 's promotion

- ▶ If the manager reports that he is **discriminatory**, the owner selects B when B 's productivity is higher than threshold δ and pays d to the manager.
- ▶ If the manager reports that he is **fair**, the owner first selects B based on the **rule above**, and pays d to the manager. If B 's productivity is less than δ , then two worker's productivities are compared to each other.

Projection Mechanism: W-bar projection mechanism

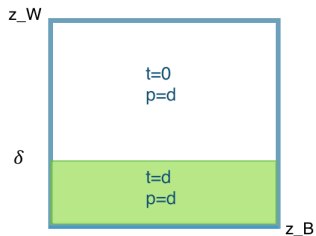


Figure: Productivity Region for
 B 's promotion

- ▶ If the manager reports that he is **discriminatory**, the owner selects B when W 's productivity is less than threshold δ and pays d to the manager.
- ▶ If the manager reports that he is **fair**, the owner always selects B , and pays d to the manager.

Projection Mechanism:

Gap projection mechanism

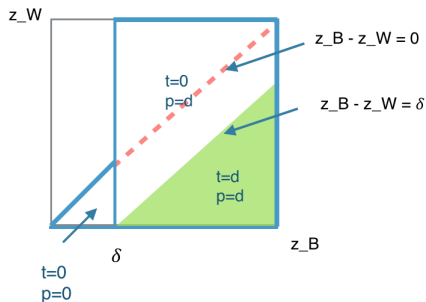


Figure: Productivity Region for B's promotion

- ▶ If the manager reports that he is **discriminatory**, the owner selects B when the two workers' productivity **gap** is higher than threshold δ and pays d to the manager.
- ▶ If the manager reports that he is **fair**, the owner first selects B when B 's productivity is higher than threshold δ , and pays d to the manager. When B 's productivity is less than threshold δ , then two worker's productivities are compared.

Profit-max Mechanism

Theorem 2

Depending on parameters (e.g., distributions on the worker's productivity, the manager's preference type), the profit-max mechanism is either Projection mechanism or Delegation mechanism.

Proof

1. The three mechanisms (Unconditional, Delegation, Projection) are incentive compatible.
2. No other mechanisms are incentive compatible
3. Unconditional mechanism is dominated by other two mechanisms in terms of expected profit.
4. The optimal mechanisms is either Projection mechanism or Delegation mechanism.

Example: $x_i \sim \text{Uniform}[0, 1]$ and $d = 0.2$

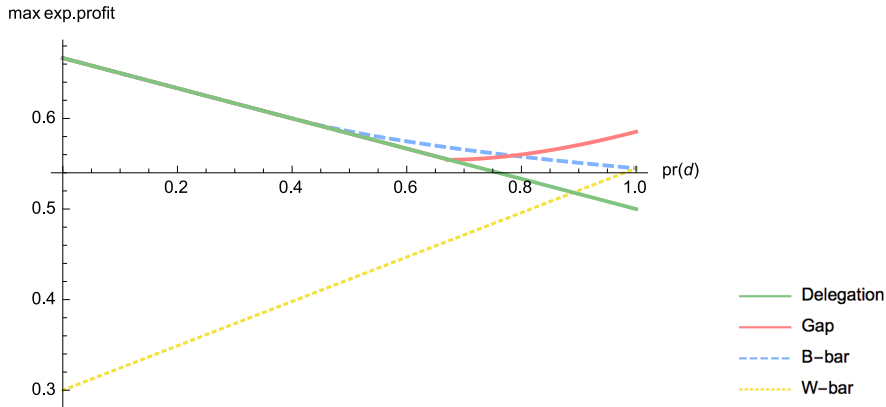


Figure: Maximum expected profits of the four mechanisms: Delegation, Gap, B-bar, and W-bar [policy](#)

Example: $x_i \sim \text{Uniform}[0, 1]$ and $d = 0.2$

$\nu(d) = 0.9$	Delegation	Gap	B-bar	W-bar
Maximum profit	0.516	0.570	0.551	0.520
Optimal threshold		0.270	0.726	0.300
$\nu(d) = 0.5$				
Maximized profit	0.583	0.583	0.585	0.422
Optimal threshold		1.000	0.904	0.300
$\nu(d) = 0.1$				
Maximized profit	0.650	0.650	0.650	0.3245
Optimal threshold		1.000	1.000	0.300

Table: Maximum expected profit and optimal threshold

Regulation

Policy Implementation

1. Suppose that the firm owns a nonatomic continuum of identical branches, where each branch has its own manager with the single promotion decision problem.
2. A regulator can observe the aggregate promotion result of the firm, the ratio of B workers in the promotion.
3. By Law of Large Numbers, from the allocation rule Q , the owner can perfectly forecast the ratio of B workers in the promotion.
4. The regulator wants such ratio to be r . If the firm fails to achieve the threshold, there is a levy τ .

Owner's problem under regulation

The promotion ratio of B with a mechanism $\langle Q, P \rangle$ is

$$\rho(Q) = \nu(d) \cdot \mu(\chi_B^d(Q)) + (1 - \nu(d)) \cdot \mu(\chi_B^0(Q)).$$

Given (r, τ) , the owner's optimization problem changes as follows combining the laissez-faire profit $\pi(\theta, x; x)$ and the regulatory penalty τ .

$$\max_{Q, P} \sum_{\theta \in \Theta} \int_{x \in X} \nu(\theta) \cdot f(x) \cdot \pi(\theta, x; x) dx - \tau \cdot \mathbf{1}_{(\rho(Q) \neq r)}$$

$$\text{s.t.} \quad u(\theta, x; \theta, x) \geq u(t, z; \theta, x) \quad \forall \theta, t \in \Theta \text{ and } \forall x, z \in X.$$

Unfairness

Given an arbitrary allocation rule Q , **unfairness of the allocation rule Q** is defined as follows:

$$\begin{aligned} \phi(Q) = & \sum_{t \in \{0, d\}} \nu(t) \cdot [\mu(x_W > x_B | x \in \chi_B^t(Q)) \cdot \mu(\chi_B^t(Q)) \\ & + \mu(x_B > x_W | x \in \chi_W^t(Q)) \cdot \mu(\chi_W^t(Q))]. \end{aligned}$$

The measure evaluates frequency of discriminatory incidents: given an allocation rule Q , worker j is promoted even though worker i 's productivity is higher than worker j 's productivity.

Lemma 17

Given an arbitrary $r \in (0, 1)$, Unconditional mechanism is more unfair than other incentive compatible mechanisms (Projection, Delegation).

$$\max\{\phi(Q^c), \phi(Q^0)\} < \phi(Q^{\lambda=r}).$$

Results

- ▶ Regulators (e.g. EEOC) can enforce an organization to promote worker B as much as they want. – Theorem 3, Corollary 4 ▶ e.g., Gap Projection Mechanism
- ▶ However, such policy decisions need caution. – Theorem 4 and Example 5
- ▶ A regulation can induce undesirable negative side effects: high frequency of unfair events by choosing a less expensive method. (by randomization) – Lemma 15 and 17

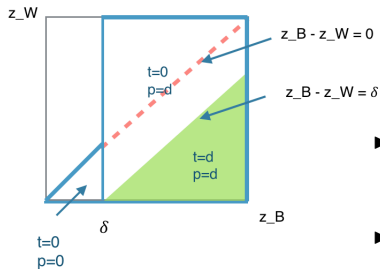
Legal Issues and Implementation

Legal issues in treatment of the manager

Communication between the owner and the manager:

- ▶ Is it legal to ask about the manager's personal characteristic regarding bias?
 - ▶ No actual harassment is involved.
 - ▶ The manager is not punished from revealing his true type. He rather receives a bonus
- ▶ Legal view and economic view might not match: in that case, another communication method (e.g. indirect questions obtaining the same information) should be designed.

Gap Projection Mechanism: Legal issues



- ▶ Imperfectly protected B : it does not 100% avoid direct discrimination.
 - Paper trails for the promotion rule \Rightarrow EEO violation; possible civil litigation
- ▶ Reverse Discrimination: - Banding and Additional point category
- ▶ Communication issues between the owner and the manager

Is there an equivalent way to implement the allocation and payment minimizing possible litigation cost?;
Otherwise, should the owner choose non-optimal mechanism (e.g. randomization)?

Alternative to Gap Projection Mechanism

- A1. The owner asks the manager only about the two workers' productivity levels.
- A2. A worker with higher reported productivity is promoted (*i* if $z_i > z_j$). The manager receives d only if the owner observes the promoted B 's productivity (x_B) is higher than δ .

The truthful reporting equilibrium outcome of the Gap Projection Mechanism can be obtained with an untruthful reporting equilibrium of the alternative mechanism.

Alternative Mechanism

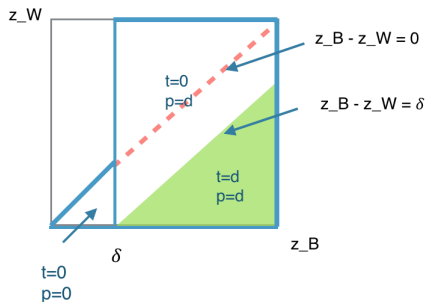


Figure: Productivity Region for B 's promotion in Gap Projection Mechanism

- ▶ If he is **discriminatory** and $x_B > \delta$, he reports productivity values with $[z_B > z_W \text{ s.t. } z_B = x_B]$ when the true productivity gap exceeds δ ($x_B - x_W > \delta$); if $x_B < \delta$, he reports $[z_W > z_B \text{ s.t. } z_W = x_W]$.
- ▶ If the manager is **fair**, he reports productivity information **truthfully only if $x_B < \delta$** . If $x_B > \delta$, he always reports $[z_B > z_W \text{ s.t. } z_B = x_B]$ to earn the bonus d regardless of the true productivity difference $x_B - x_W$.

Conclusion

1. a. What the owner can do best to reduce the discriminatory decisions without compromising the firms profit - **Importance of providing incentives reducing the bias**
 - b. Do profit maximizing decisions by the owner mitigate the manager's discretion completely, **partially**, or not at all?
2. A regulation can improve on the best laissez-faire allocation in terms of the promotion ratio in minority workers. However, it can lead to more unfair situations when it's too aggressive.

Thank you!

wiroypsu@gmail.com

Legal Issues on Implementation

The core statutes

The Civil Rights Act of 1964 is the main law prohibiting discrimination in employment opportunities (Title VII; e.g. hiring, job assignments, promotions, pay and benefits, and discharge) and educational opportunities (Title IV; e.g. college admission).

“Title VII of the Civil Rights Act of 1964 (Title VII) makes it unlawful to discriminate against someone on the basis of race, color, national origin, sex or religion. The Act also makes it unlawful to retaliate against a person because the person complained about discrimination, filed a charge of discrimination, or participated in an employment discrimination investigation or lawsuit.”

Affirmative action

Affirmative action measures can be adopted in three circumstances

1. Voluntary affirmative action
2. Court-ordered affirmative action
3. Affirmative action for under-represented minorities and women in workplaces of contractors of the federal government

Weber test

1. There must be a manifest imbalance in the relevant workforce.
2. The plan cannot unnecessarily trammel the rights of non-beneficiaries.
3. The plan must be temporary, seeking to eradicate traditional patterns of segregation.

Legal cases in the U.S. and their implications

- ▶ Layoff or replacement trammel the rights of non-beneficiaries.
- ▶ Quotas are generally not allowed, but exception exists in court-ordered affirmative action.
- ▶ Preferential treatment can be used: different cutoff levels are not allowed, but demographic identity can be used as an additional point category. Banding (e.g. test scores are categorized by ranges and compared by the category) might be allowed, but point boosting is not allowed.
- ▶ Improving diversity can be part of goals of educational institution. However, in workplaces, a justification of an operational need for diversity is limited without evidence of past discrimination.

Gap Projection Mechanism

The Gap Projection Mechanism has affirmative action components and ameliorates the discriminatory outcome of the status quo.

- ▶ it provides a bonus to the manager for promoting B when conditions are met.
- ▶ compared to the status quo, it increases a promotion ratio of B .