Lec7: Compensating Wage Differentials

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Introduction

- Why we always observe that there is a huge wage differences among workers in the market?

  1. Different qualities of the workers(human capital)

  2. Different jobs workers hold

  3. The Same quality and the same job

  4. Mobility barriers

- In reality, we observe substantial wage differences, both within industry sectors and across industry sectors.

- The theory of compensating wage differentials seeks to explain wage differentials across industry sectors.

- The theory of compensating differentials addresses nonpecuniary aspects of job differences.

Job Attributes

- Intercity and interregional differences in
  - Climate, crime, pollution, crowding
- Onerous working conditions
  - Risks to life and health; exposure for pollution, ...
- Special work-time scheduling and related work requirements
  - Shift work, inflexible work schedules
  - possible risks of layoff and subsequent unemployment
- Composition of pay packages
 - Substitution of fringe-benefits for cash wage

Compensating Wage Differentials

Compensating Wage Differentials

- The theory of compensating wage differentials suggests that wage differentials exist, in part, to compensate workers for differences in the nonpecuniary characteristics of alternative types of employment

  - First expressed in detail in 1776 by Adam Smith in the Wealth of Nations (Book I: Chapter X)
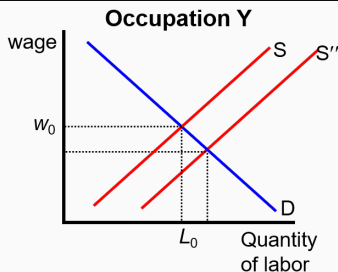
An Easy Example

- In reality, Occupation X has higher "risks" than Occupation Y

- Some workers will migrate from X to Y

- Migrate until wage satisfies the difference in risks
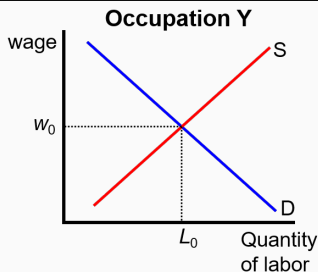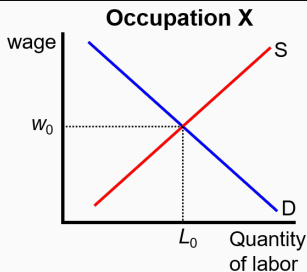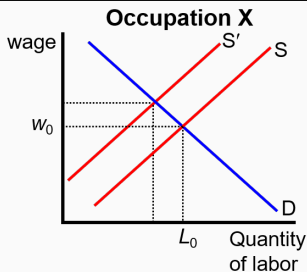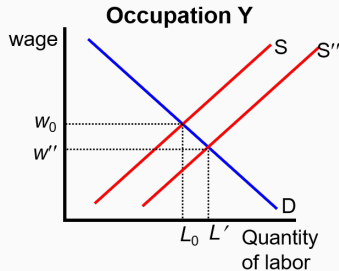
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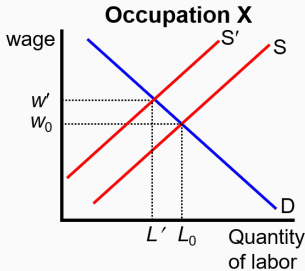# An Easy Example

- The difference in wage of W′-W″ is the amount that a worker must be compensated to accept the risky position

- The difference in wage of W′-W″ is compensating wage differential

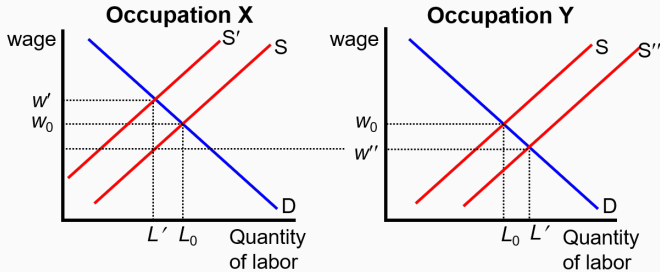- Can be thought of as occupation X's risk premium

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The Basic Idea

- A labor market transaction is viewed as a *tie-in sale*

  1. A worker simultaneously sells the services of his labor and buys the attributes of the job

  2. Employers simultaneously buy the services and characteristics of workers and sell the attributes of job offered to the market

- An acceptable match occurs when the preferred choices of an employer and an employee are mutually consistent

  1. When the worker finds the employer's job attributes to be the most desirable

  2. the employer finds the worker's productive characteristics to be the most desirable

Interpreting Equilibrium Wage

- Actual wage derives from 2 transactions
  - worker characteristics
  - Job attributes
- Preferred job attributes
  - A positive price is subtracted from the wage
- Onerous job attributes
  - A wage premium is added to the wage
- Observed wage clears both market
  - Worker characteristics
  - Job attributes

TABLE 5-1
Injury Rates in the United States, by Industry, 2002

Source: U.S. Department of Commerce, *Statistical Abstract of the United States, 2004*, Washington, DC: Government Printing Office, 2004, Tables 634, 636.

Industry	Nonfatal Injuries per 100 Full-Time Workers	Fatal Injuries per 100,000 Workers
Agriculture	6.4	23
Mining	4.0	24
Coal	6.8	29
Oil and gas extraction	3.4	23
Construction	7.1	12
Manufacturing	7.2	3
Food and kindred products	9.3	3
Lumber and wood products	10.1	20
Transportation and public utilities	6.1	11
Local passenger transit	7.9	9
Trucking and warehousing	7.0	21
Transportation by air	11.8	9
Wholesale trade	5.2	4
Retail trade	5.3	2
Finance	1.7	1
Services	4.6	2
Business services	2.7	2
Auto repairs	4.5	7

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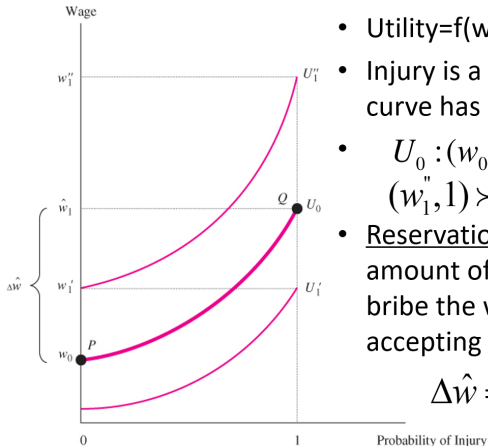# Risky Jobs

The Market for Risky Jobs

- A simple example of binary choice
- Two types of jobs:
    - Completely safe jobs: prob(injury)=0
    - Inherently risky jobs: prob(injury)=1
- Assume that workers have complete information
- The supply and demand curve to risky jobs
- Then How to obtain the Equilibrium in the market?

FIGURE 5-1 Indifference Curves Relating the Wage and the Probability of Injury on the Job

The worker earns a wage of w_0 dollars and gets U_0 utils if she chooses the safe job. She would prefer the safe job if the risky job paid a wage of w_1' dollars, but would prefer the risky job if that job paid a wage of w_1'' dollars. The worker is indifferent between the two jobs if the risky job pays $\hat{w}_1$. The worker's reservation price is then given by $\Delta \hat{w} = \hat{w}_1 - w_0$.

- Utility=f(w, r), r-risk to injury
- Injury is a "bad" good, so ind curve has a negative slope.
- $U_0 : (w_0, 0) \sim (\hat{w}_1, 1)$
  $(w_1'', 1) \succ (\hat{w}_1, 1) \succ (w_1', 1)$
- <u>Reservation price</u>: the amount of money it takes to bribe the worker into accepting the risky job.

$$\Delta \hat{w} = \hat{w}_1 - w_0$$

- Different people have different reservation prices for the risky job

  - Preferences: People with flat indifference curve have lower reservation price

- Number of workers willing to work in the risky job at each wage gap b/w the risky job and the safe job – <u>supply curve</u> to the risky job

  - slopes up because as the wage gap between the risky and safe jobs increase, more and more workers are willing to work in the risky job

Supply Curve
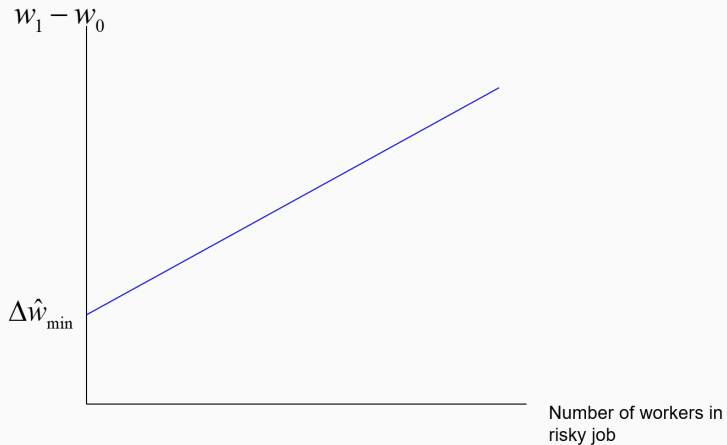
Firm's Choice in Safe and Risky Environment

- Choices facing the firm:
    - Offer a safe environment, save on labor costs, and divert resource to producing safety
    - Provide a risky environment and pay higher wages
- The cost of reducing risk depends on technology
- For a given technology, willingness to invest in safe environment is positively related to the wage gap between risky and safe jobs

Demand Curve for the Risky Job

- Different firms have different technologies, thus facing different costs in reducing risks.
- As the wage gap between risky and safe jobs rises
  - More firms are willing to provide safe environment
  - Fewer firms are willing to provide risky jobs
- Demand curve for workers in risky positions slopes down
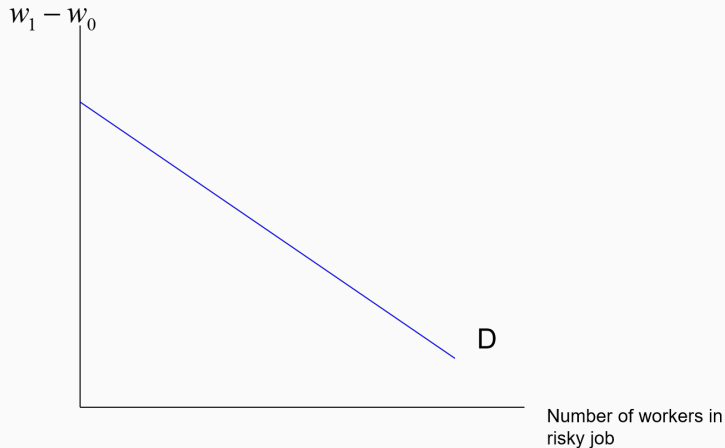
Equilibrium

- Compensating wage differential: $(w_1 - w_0)^*$
- Matching equilibrium:
    - Workers with least aversion to risk work for firms with high cost of reducing risk
- Reached through worker mobility
- Prediction: The differential is positive:
    - Risky jobs pay more than safe jobs
    - Follows from our assumptions that workers dislike risk
- It is marginal wage differential
    - All workers except for the marginal worker are over-compensated by the market (rent)

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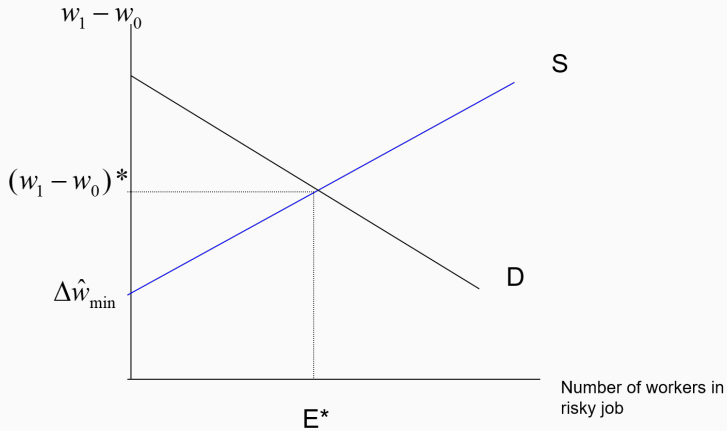
Caveats About the Theory

- Assumptions
  - Utility, not income maximization
  - Worker information
  - Worker mobility
- Holding other things equal
  - Worker characteristics
  - Ability
  - Careful in interpreting observed wage differential as compensating wage differential

The Hedonic Wage Theory

- Generalization
  - Describe matching explicitly

- Instead of having only 2 types of jobs, a risky job and a safe job, there are now many types of firms

- The probability of injury can take on any value between 0 and 1

# Indifference Curves for Three Types of Workers
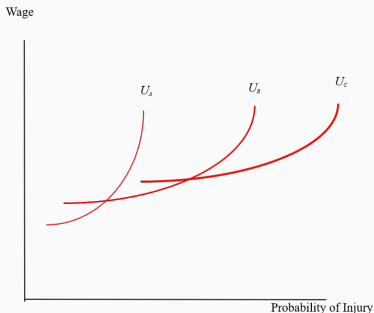
- Different workers have different preferences for risk.
- Worker A is very risk-averse.
- Worker C does not mind risk very much at all.
- Worker B is between the two.

Isoprofit Curves
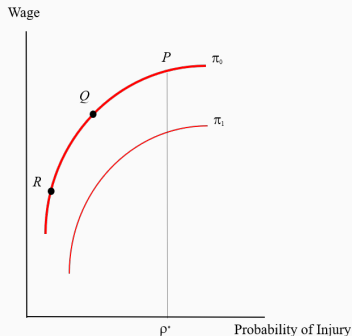
- An isoprofit curve gives all the risk-wage combinations that yield the same profits.
- Because it is costly to produce safety, a firm offering risk level ρ^* can make the workplace safer only if it reduces wages (while keeping profits constant), so that the isoprofit curve is upward sloping.
- Note: higher isoprofit curves yield lower profits.

The Hedonic Wage Function
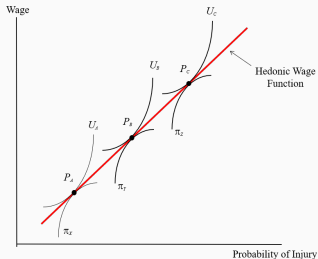
- Different firms have different isoprofit curves and different workers have different indifference curves.
- The labor market marries workers who dislike risk (such as worker A) with firms that find it easy to provide a safe environment (like firm X);
- and workers who do not mind risk very much (worker C) with firms that find it difficult to provide a safe environment (firm Z).
- The observed relationship between wages and job characteristics is

Empirical Specification

-

$$w_i = \alpha + \sum_{m=1}^{M} \psi_m x_{im} + \gamma p_i + \text{other\_variables}$$

- w: log wage rate

- X: individual characteristics

- p: the probability of injury

- Data: a cross section of worker sample

- A linear curve assumes constant rate of tradeoff at all levels of risk

- $\partial w / \partial p$ estimates the wage-risk tradeoff

Empirical Results

- Many empirical studies report a positive relation bw wages and hazardous or unsafe work conditions.

- Workers who are exposed to hazardous materials or equipment earn about 3 to 4% more than workers who are not.

- Workers in jobs that involve physical stress earn about 6% more than workers in other jobs.

- Workers who are exposed to high probabilities of fatal injuries earn more.

- There is a great deal of variations in the size of estimated effect.

- A survey concluded that 0.001 point increase in the probability of fatal injury may increase annual earnings by about $6000 (1998 prices)

James K. Hammitt and Jin-Long Liu(1997),"Estimated Hedonic Wage Function and Value of Life in a Developing Country," Economics Letters

Table 2
Risk variable estimations in hedonic wage equations

	Year				
	1982	1983	1984	1985	1986
OLS estimation:					
RISK	0.0121	0.0096	0.0029	0.0074	0.0123
	(16.331)	(10.367)	(7.251)	(9.370)	(11.245)
Value of Life (1990 US$)	582 000	493 000	151 000	398 000	683 000
Heckman Two-Stage Estimation:					
RISK	0.0112	0.0086	0.0026	0.0067	0.0106
	(15.006)	(9.548)	(6.684)	(8.715)	(9.989)
Value of Life (1990 US$)	539 000	442 000	135 000	360 000	589 000

Notes: Values of *t*-ratio are in parentheses. The wage function includes human capital variables, individual characteristics, occupational dummy variables, and site attribute variables. The human capital variables are EDU, EDU squared, EXPER, EXPER squared. Occupational dummy variables are professional, manager, clerk, sales, service, and operator. The transportation occupational dummy variable is omitted. Site attribute variables are number of secondary school students per class in town of residence, population density, unemployment rate in town, criminal offenses in town per 10 000 population, town population per medical doctor, cinema and theatre seats per 1000 population, average temperature, average precipitation, and average suspended particulates in town.

Compensating Wage Differential in China

- 邓曲恒和王亚柯,"农民工的工作条件与工资收入: 以补偿性工资差异为视角",《南开经济研究》,2013 年第 6 期。

- 使用中国社会科学院经济研究所 2006 年的农民工调查数据,结果表明

  - 农民工在城市劳动力市场并不能获得补偿性工资差异。

  - 主要原因是城市劳动力市场对农民工是分割的。

The Monetary Value of Life in China

- 秦雪征，刘阳阳，李力行，"生命的价值及其地区差异: 基于全国人口抽样调查的估计"，《中国工业经济》，2010 年第 6 期。

- 本文利用 2005 年全国 1% 人口抽样调查数据，依据国际标准的"享乐主义工资模型"，对我国人口的生命统计学价值进行估算，并对城乡之间及东西部地域之间的生命价值进行比较。

    - 我国劳动力生命价值约为181 万元人民币 (按 2000 年美元折合约 19 万美元)。

    - 我国城镇与农村人口在生命价值上的差异高达 4.3 倍 (城镇为 384 万; 农村为 89 万)，反映出我国城乡之间收入的严重失衡以及劳动力市场的分割。

Policy Application

Policy Application: Safety and Health Regulation

- Questions to analyze:

    - Is there a need for the regulation?

    - What should be the goal of a regulation?

- Occupational Safety and Health Act, 1970

- Create Occupational Safety and Health Administration (OSHA) in the DoL

- Issue and enforce safety and health standards for all private employers

- Goal: achieve "Highest degree of health and safety protection for the employee"

## Policy Application: Safety and Health Regulation

- OSHA is charged with the protection and health of the American labot force.

- OSHA sets regulations that are aimed at reducing risks in the work envionment.

- Mandated standards reduce the utility of workers and the profits of firms.

- Safety regulations can improve workers' welfare as long as they consistently underestimate the true risks.

Impact of OSHA Regulation on Wage, Profits, and Utility
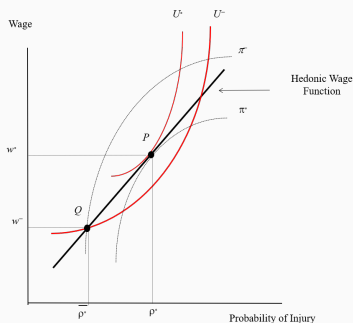
- e A worker maximizes utility by choosing the job at point P, which pays a wage of w^* and offers a probability of injury of ρ^*.
- The government prohibits firms from offering a probability of injury higher than $\overline{\rho^*}$, shifting both the worker and the firm to point Q.
- As a result, the worker earns a lower wage and receives less utility (from U^* to U^-),and the firm earns

# Impact of OSHA Regulation when Workers Misperceive Risks
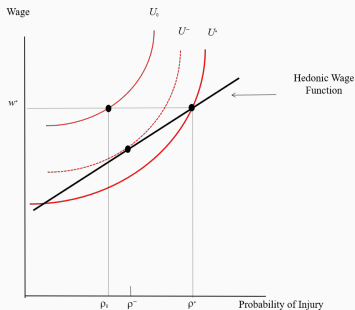
- Workers earn a wage of w^* and incorrectly believe that their probability of injury is only ρ_0.
- In fact, their probability of injury is ρ^*.
- The government can mandate that firms do not offer a probability of injury higher than ρ^-, making the uninformed workers better off (that is, increasing their actual utility from U^* to U^-).

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## Compensating Differentials and Job Amenities

- Good job characteristics are associated with low wage rates.

- Bad job characteristics are associated with high wage rates.

- The evidence is not clear on the link between amenities and wage differentials, except for the risk of death.

- Examples of amenities: job security, predictability of layoffs, work schedules, work hours, safety, etc.

Income

Wage = w_0

Wage = w_1

P

R

U_0

U'

Q

L_0 L_1 T Hours of Leisure

h_0 h_1 0 Hours of Work
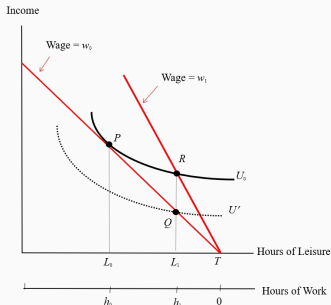
- At point P, a person maximizes utility by working h_0 hours at a wage of w_0 dollars.
- An alternative job offers the worker a seasonal schedule, where she receives the same wage but works only h_1 hours.
- The worker is worse off in the seasonal job (her utility declines from U_0 to U' utils).
- If the seasonal job is to attract any workers, the job

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Health Benefits and Compensating Differentials
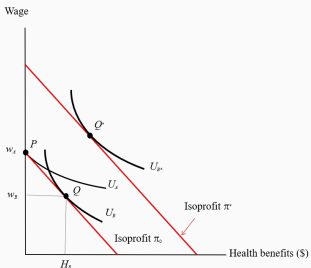
- Workers A and B face the various compensation packages offered by isoprofit curve π_0.
- Worker A chooses a package with a high wage and no health insurance benefits.
- Worker B chooses a package with wage w_B and health benefits H_B.
- In contrast, workers B and B^* have different earnings potential, so their job packages lie on different isoprofit curves.
- Their choices generate a positive correlation between wages and health benefits.

- "富士康跳楼事件": 据媒体报道，2010 年共发生 15 起自杀事件，至今仍然时有发生。

- Steve Jobs said: "Foxconn is NOT a sweatshop."

- But the media and the public didn't agree with that.

- Q: What are your opinions? How to understand the situation?

- 《外卖骑手，困在系统里》
- "饿了吗"回应："你愿意多给我 5 分钟吗?"
- 观点:
  - 顾客之恶
  - 算法之恶
  - 资本之恶
  - 无人之恶
- Q: What are your opinions? How to understand the situation?