Lecture 7: Compensating Wage Differentials

Labor Economics, Fall 2025

Zhaopeng Qu
Business School, Nanjing University
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Introduction

Introduction

Why do we observe substantial wage differences among workers in the market?

- 1.**Different qualities of the workers** (human capital or signaling)
- 2.**Different jobs workers hold** (compensating wage differentials)
- 3.**The same quality and the same job**(Discrimination)
- 4.**Mobility barriers**(labor market segmentation or frictions)

Introduction

- 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.

Nonpecuniary Job Attributes

1. Intercity and interregional differences:

- Climate, crime, pollution, crowding

2. Onerous working conditions:

- Risks to life and health; exposure to pollution, hazardous materials

3. Special work-time scheduling and related work requirements:

- Shift work, inflexible work schedules and possible risks of layoff or unemployment

4. Composition of pay packages:

- Substitution of fringe benefits or other rewards for cash wage

Compensating Wage Differentials

Compensating Wage Differentials(补偿性工资差异)

The Basic Theory

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)

> The whole of the advantages and disadvantages of different employment of labour and stock must, in the same neighbourhood, be either perfectly equal or continually tending to equality.
>
> — Adam Smith

An Easy Example

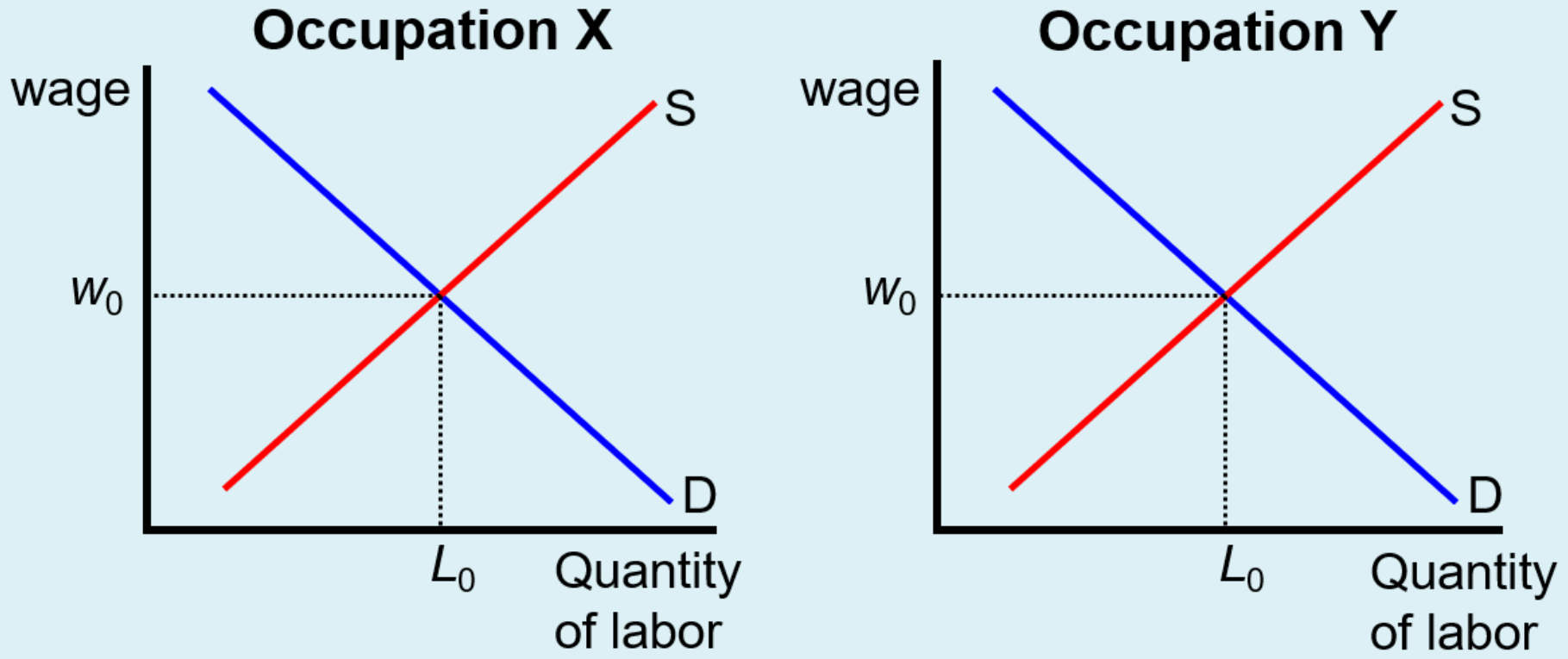
Let's think about two occupations:

- **Occupation X**: Higher risks
- **Occupation Y**: Lower risks

What happens?

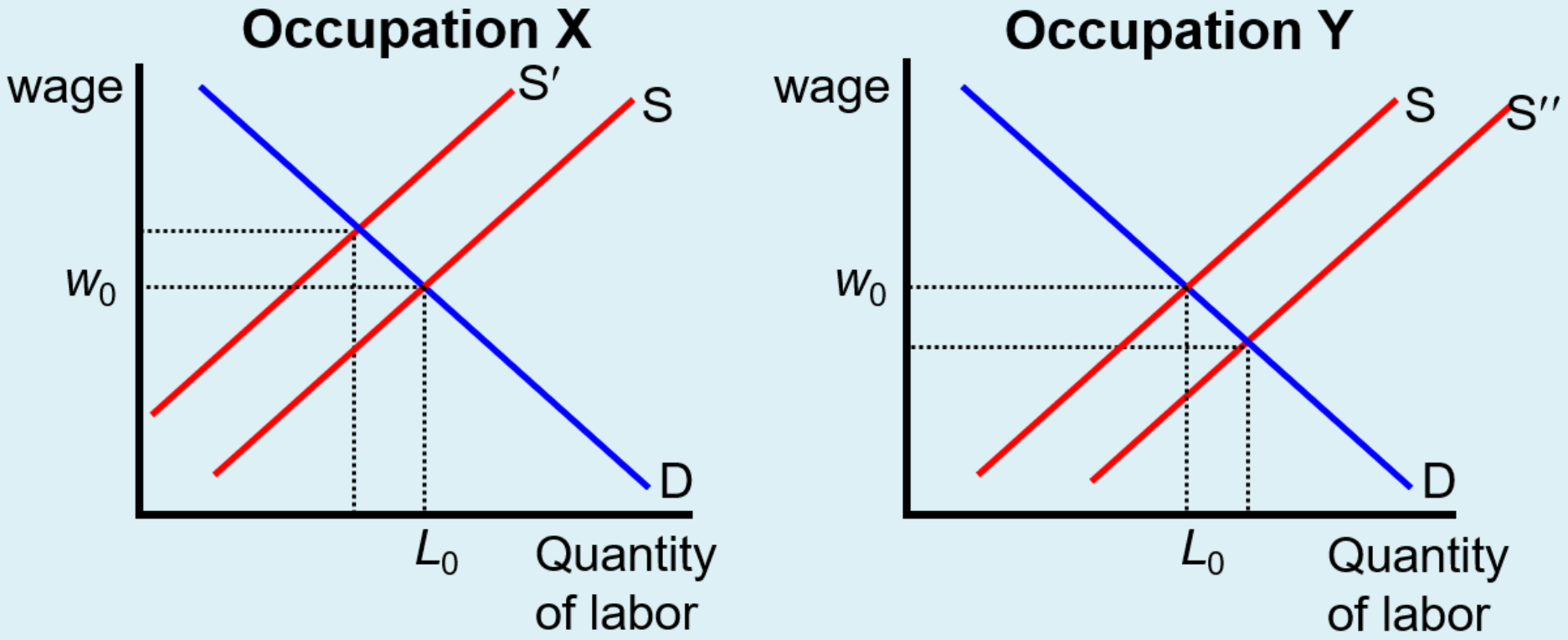
- Some workers will migrate from X to Y
- Migration continues until the wage gap compensates for the difference in risk

An Easy Example



- The initial situation where both occupations might pay similar wages though they have different risks.

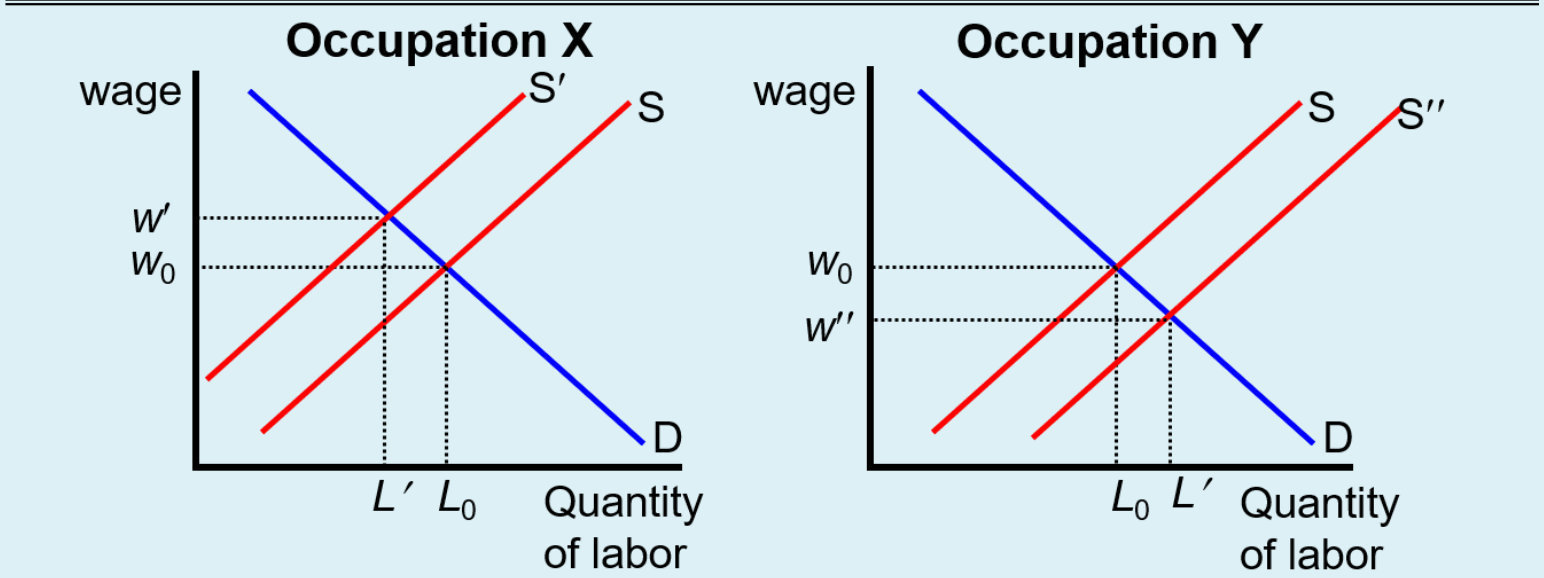
An Easy Example(Continued)



- Workers migrate from job Y to job X until the wage gap compensates for the difference in risk.

Compensating Wage Differential

- The wage difference here $W' - W''$ is the amount that a worker must be compensated to accept the risky position.
- This wage difference $W' - W''$ is the **compensating wage differential**.
- This wage difference can be thought of as **Occupation X's risk premium**.



Compensating Wage Differential(Continued)

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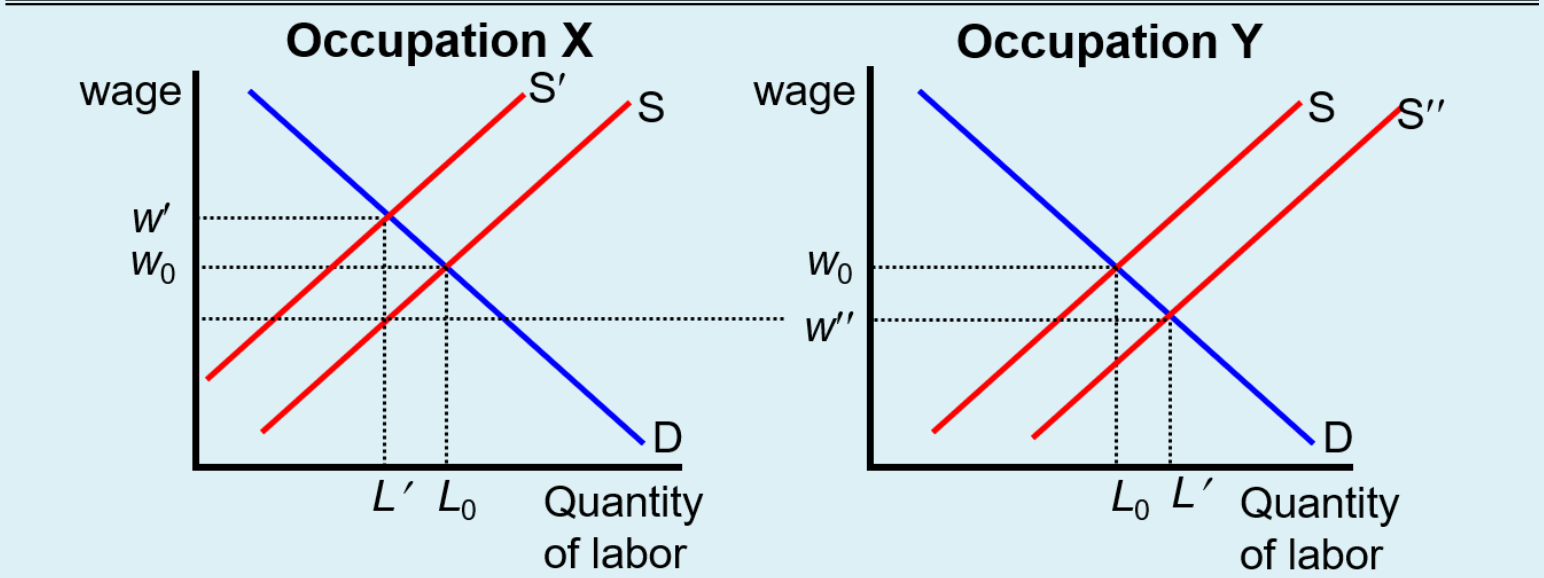

New Way to Think about the Labor Market

A labor market transaction is viewed as a **"tie-in sale"**(捆绑销售):

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 the job offered to the market

An **acceptable match** occurs when:

- The worker finds the employer's job attributes most desirable
- The employer finds the worker's productive characteristics most desirable

Interpreting Equilibrium Wage

The actual wage derives from **TWO** transactions:

1. **Worker characteristics** (human capital, productivity)
2. **Job attributes** (risk, location, schedule, etc.)

- **For preferred job attributes:** **A positive price is subtracted from the wage**
- **For onerous job attributes:** **A wage premium is added to the wage**

The **observed wage** clears both markets:

- **Market for worker characteristics**
- **Market for job attributes**

Injury Rates in the US, 2002

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

Injury Rates in the US, 2002(Continued)

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- Injury rates varied substantially across different industries in the United States.

The Market for Risky Jobs

The Market for Risky Jobs

A Simple Model

Two types of jobs:

- Completely safe jobs: prob(injury) = 0
- Inherently risky jobs: prob(injury) = 1

Assumption: Workers have **complete information** about risks

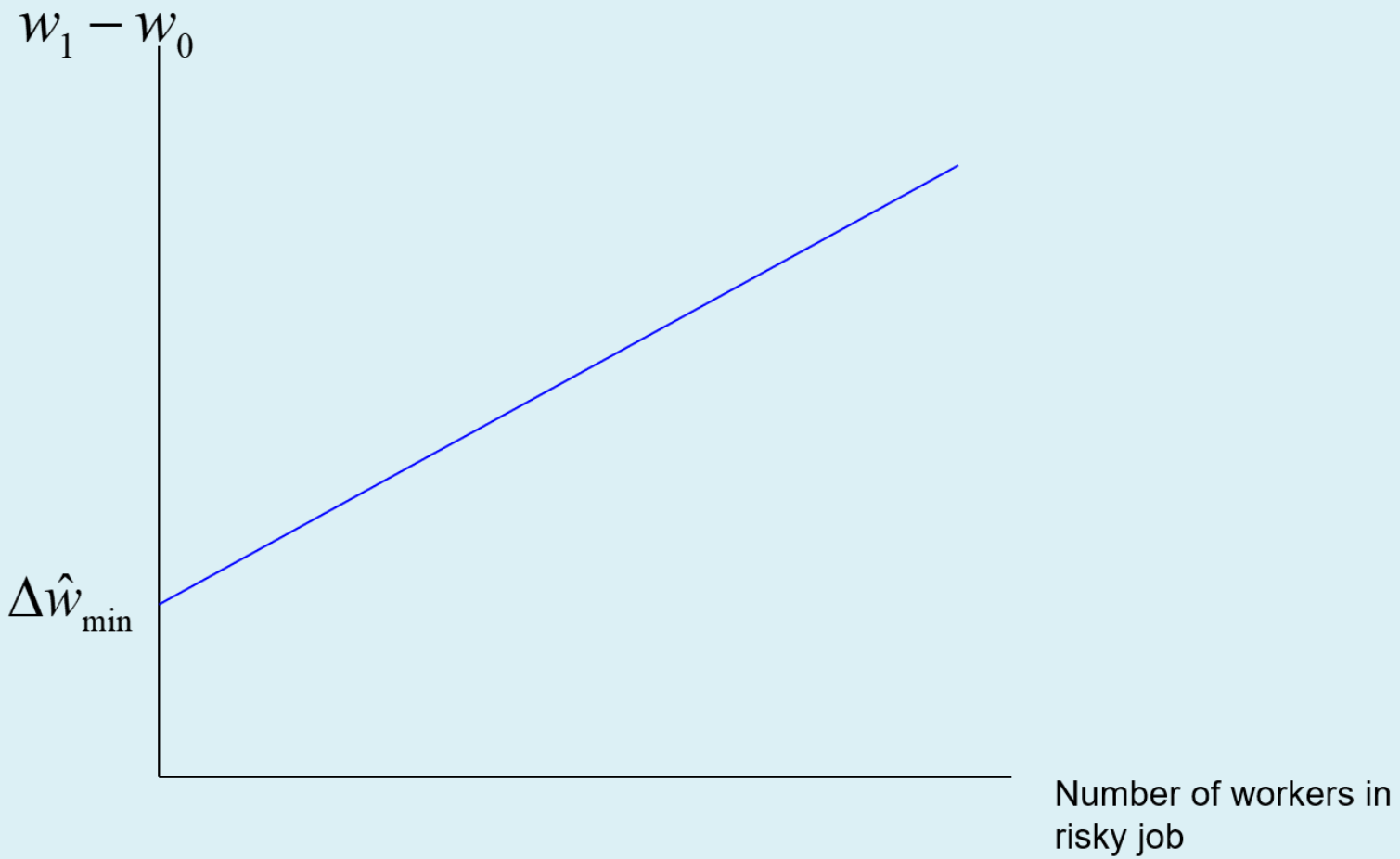
Question: How do we obtain equilibrium in this market?

We need to derive: **Supply curve to risky jobs** and **Demand curve for risky jobs**

Supply Curve to the Risky Job

- **Different people have different reservation prices for the risky job**
- **Preferences:** People with flatter indifference curves have lower reservation prices
- **Supply curve: Number of workers willing to work in the risky job at each wage gap between the risky job and the safe job**
- **Slopes upward:** As the wage gap increases, more and more workers are willing to work in the risky job

Supply Curve



- ΔW_{min} is the **minimum compensating wage differential**.

Firm's Choice: Safe vs. Risky Environment

Choices facing the firm:

1. Offer a safe environment, save on labor costs, and divert resources to producing safety environment.

2. Provide a risky environment and pay higher wages

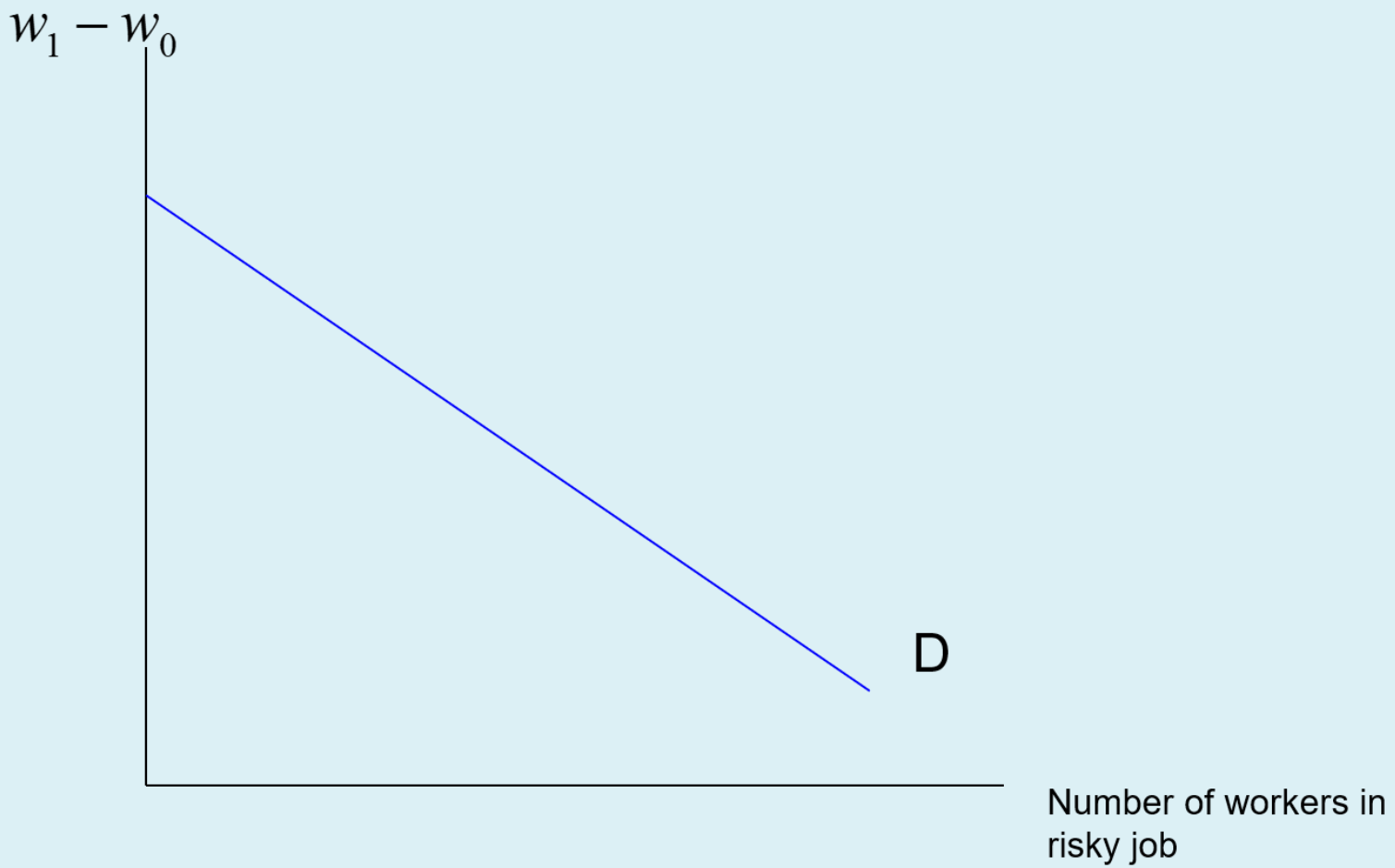
- The **cost of reducing risk** depends on technology

- For a given technology, willingness to invest in safety 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 downward**

Demand Curve for the Risky Job

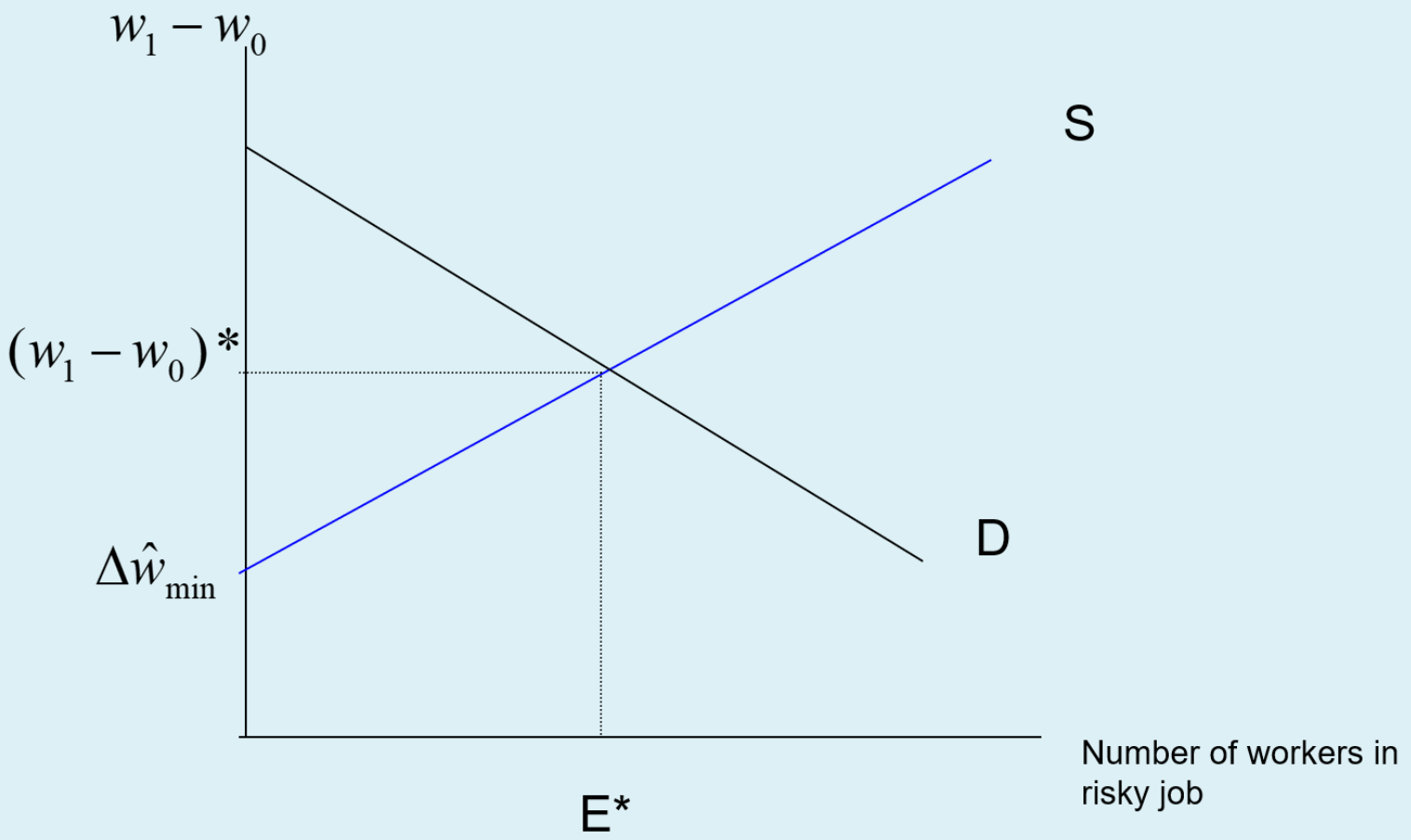


- ΔW_{max} is the **maximum compensating wage differential**.

Equilibrium in the Risky Job Market

- **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**
- **Key prediction: The differential is positive because risky jobs pay more than safe jobs.**

Equilibrium



Caveats About the Theory

Important assumptions:

1. **Utility maximization**, not just income maximization
    - Workers care about total utility, not just money
2. **Worker information**
    - Workers must know the true risks they face
3. **Worker mobility**
    - Workers can freely move between jobs
4. Workers do have options.

The Hedonic Wage Theory

The Hedonic Wage Theory

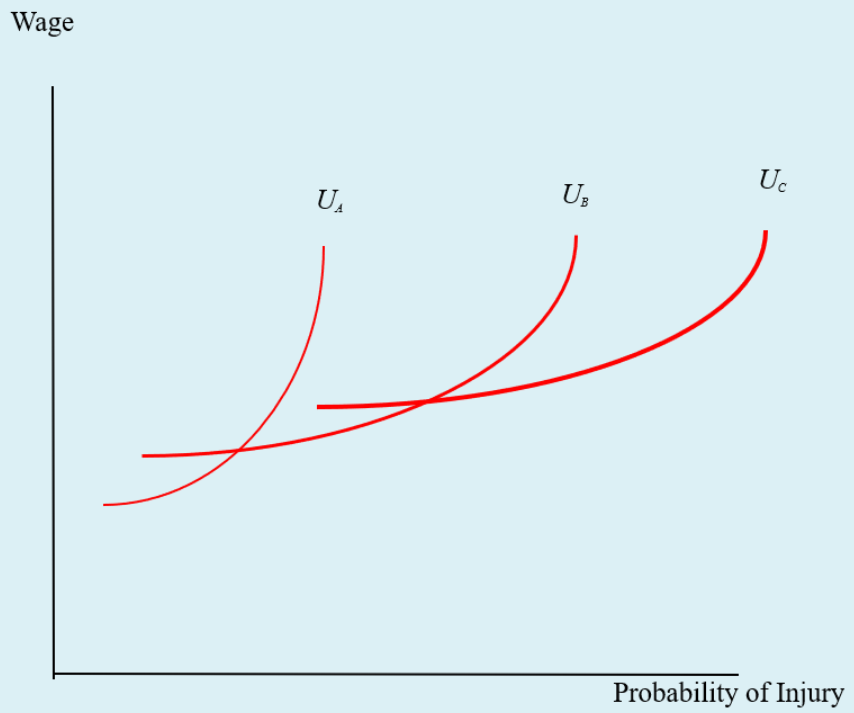
Generalization of the Simple Model

- Instead of having only 2 types of jobs (risky vs. safe), there are now **many types of firms**.
- The **probability of injury** can take on any value between 0 and 1.

This leads to the **Hedonic Wage Theory**:

- Describes explicit matching between workers and firms
- Generates a smooth relationship between wages and job characteristics

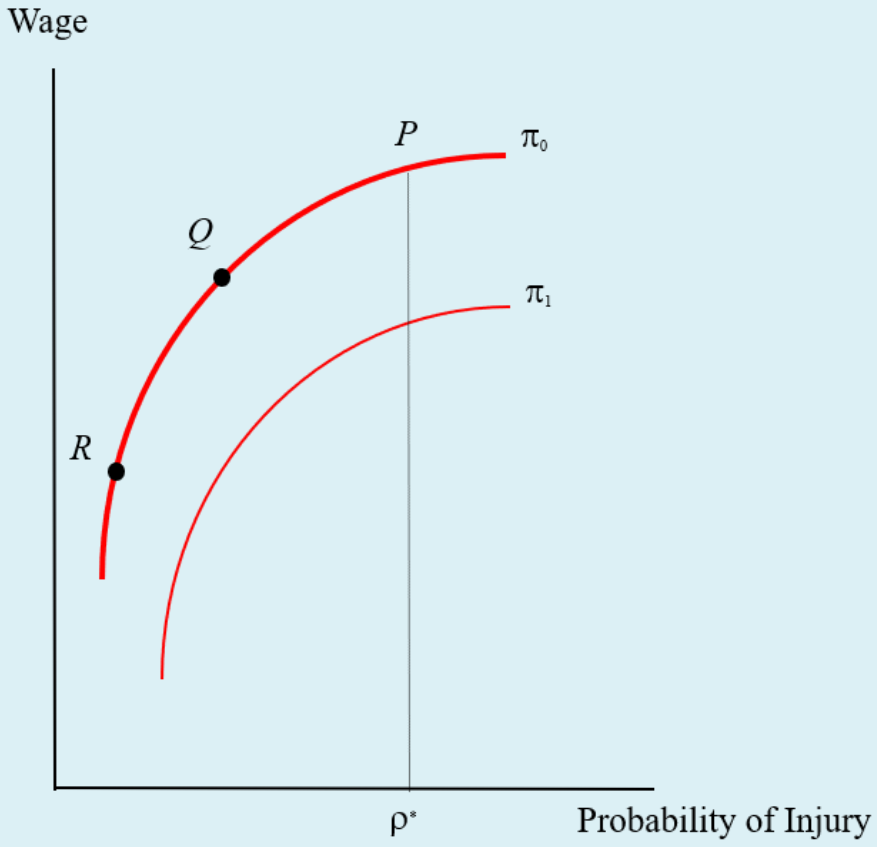
Indifference Curves for Three Types of Workers



Different workers have different preferences for risk:

- **Worker A** is very risk-averse
  - Steep indifference curve
- **Worker C** does not mind risk very much
  - Flat indifference curve
- **Worker B** is between the two
  - Intermediate slope

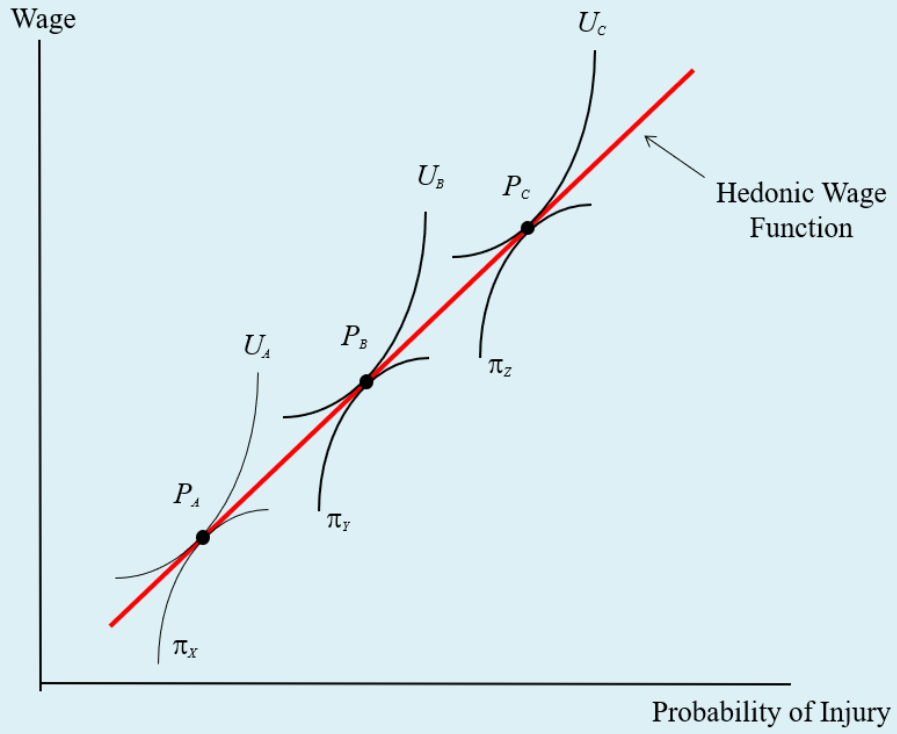
Isoprofit Curves for Firms



Isoprofit curves for firms:

- Shows all wage-risk combinations yielding the same profit
- **Upward sloping:** It is costly to produce safety
  - To reduce risk, must reduce wages (keeping profit constant)
- **Higher isoprofit curves** yield **lower profits**

The Hedonic Wage Function



The market matches workers and firms:

- Risk-averse workers (A) match with firms that find safety easy/cheap (X)
- Risk-tolerant workers (C) match with firms that find safety difficult/expensive (Z)

The observed relationship is the **hedonic wage function**

Empirical Specification

- **How do we estimate this empirically?**

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

where:

- w_i: log wage rate for individual i
- x_{im}: individual characteristics (education, experience etc.) in m dimensions
- p_i: the probability of injury for individual i
- γ: estimates the wage-risk tradeoff

- **Interpretation:** $\partial w / \partial p$ estimates the compensating differential

- Some extensions to the model: *non-linearity, interaction terms,* etc.

Empirical Results

What do the studies find?

- Many studies report a **positive** relation between wages and hazardous or unsafe work conditions
- Workers exposed to hazardous materials or equipment earn about **3-4% more** than workers who are not
- Workers in jobs involving physical stress earn about **6% more** than workers in other jobs
- Workers exposed to high probabilities of **fatal injuries** earn significantly more
- However, there is great deal of **variation** in the size of estimated effects across studies.

Results on Fatal Injuries

- **Valuing life through wage premiums:**
- A survey of studies concluded: **0.001 point increase in the probability of fatal injury may increase annual earnings by about $6,000 (1998 prices)**
- **Implication: This can be used to calculate the Value of Statistical Life (VSL)**
  - If workers require **$6,000** to accept **0.001 additional death risk**
  - Then the implied VSL = **$6,000 / 0.001 = $6 million**
- **Policy use:** Governments use VSL estimates for cost-benefit analysis of safety regulations.

Hedonic Wage Function in China

Hammitt and Liu (1997): "Estimated Hedonic Wage Function and Value of Life in a Developing Country"

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 (2013): "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

Data: 农民工调查数据 (Chinese Academy of Social Sciences, 2006)

Main finding:

- 农民工在城市劳动力市场并 不能获得补偿性工资差异

Explanation:

- 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 (2010): "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

Data: 2005年全国1%人口抽样调查数据

Main findings:

- 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）
- 城镇与农村人口在生命价值上的差异高达 **4.3倍**
  - 城镇: 384万元
  - 农村: 89万元
- 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

Summary and Conclusion

1. **Compensating wage differentials** explain why similar workers earn different wages

2. **Market equilibrium** matches different workers with different firms.

1. **Hedonic wage function** describes the market tradeoff.

2. **Policy implications** depend on whether workers are informed

3. **Real-world complications** prevent perfect compensating differentials

Discussion Cases

Discussion: Sweatshops and Foxconn

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.

Discussion: "困在系统和算法里的骑手"

- 《外卖骑手, 困在系统里》
- "饿了么" 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 do you understand this situation using compensating wage differentials theory?