

COMPENSATING WAGE DIFFERENTIALS

Introduction



- The labor market is not characterized by a single wage: workers differ and jobs differ.
- Adam Smith proposed the idea that job characteristics influence labor market equilibrium.
- Compensating wage differentials arise to compensate workers for nonwage characteristics of the job.
- Workers have different preferences and firms offer different working conditions

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- Smith argued that **compensating wage differentials** arise to compensate workers for the nonwage characteristics of jobs
 - According to Smith, it is not the wage that is equated across jobs in a competitive market, but the “whole of the advantages and disadvantages” of the job.
 - Firms that have unpleasant working conditions must offer some offsetting advantage (such as a higher wage) in order to attract workers; firms that offer pleasant working conditions can get away with paying lower wage rates (in effect, making workers pay for the enjoyable environment).

The Market for Risky Jobs

- Suppose there are only two types of jobs in the labor market
 - ▣ Some jobs offer a completely safe environment, and the probability of injury in these jobs is equal to zero
 - ▣ Other jobs offer an inherently risky environment, and the probability of injury in those jobs is equal to one
- We will assume that the worker has complete information about the risk level associated with every job
 - ▣ The worker knows whether she is employed in a safe job or a risky job



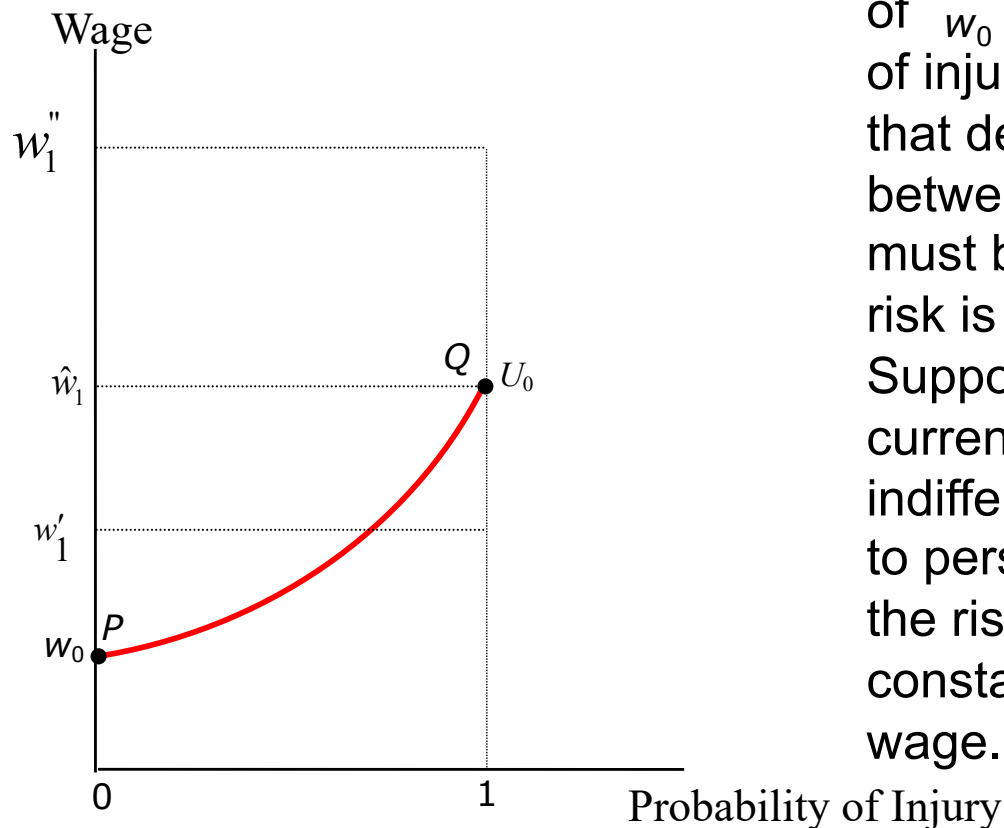
Workers care about whether they work in a risky job or safe job. They also care about the wage they earn on the job.

The worker's utility function

$$\text{Utility} = f(w, \text{risk of injury on the job})$$

- We assume that
 - ▣ workers prefer higher wages, so that the marginal utility of income is positive
 - ▣ Risk is a “bad” so that the marginal utility of risk is negative

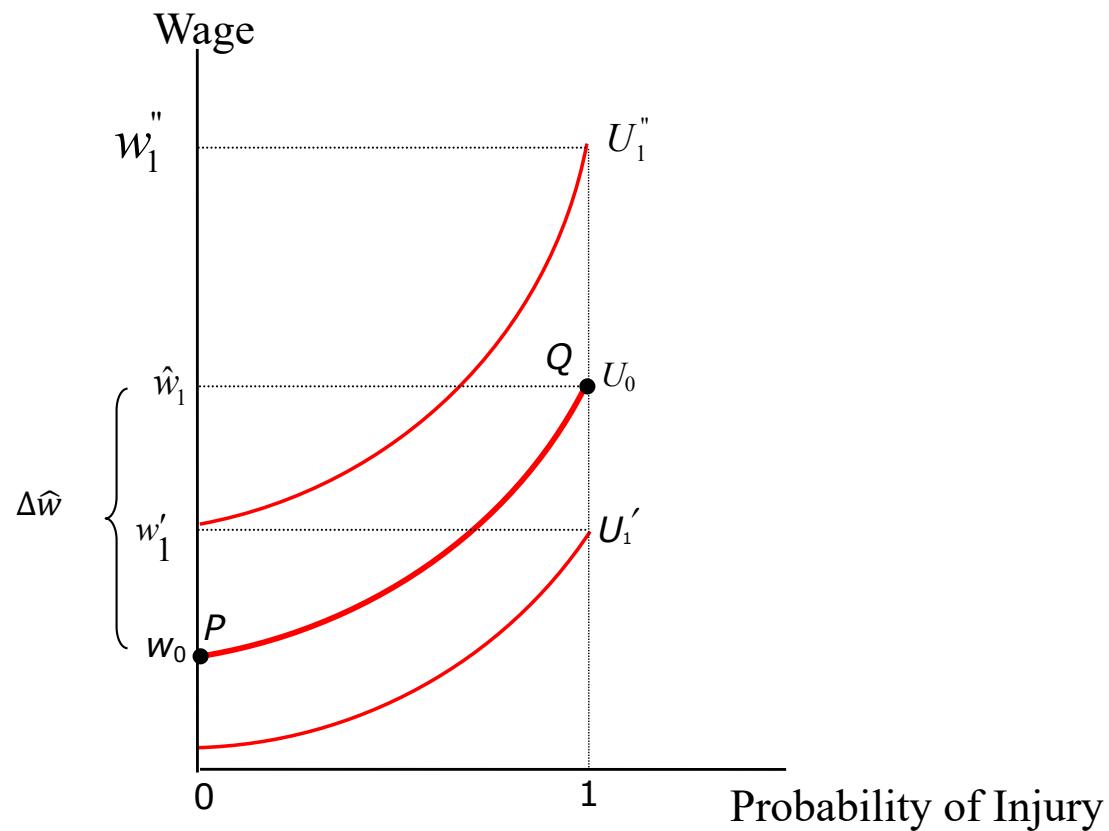
Indifference Curve Relating the Wage and the Probability of Injury on the Job



At point P, the worker gets a wage of w_0 and has a zero probability of injury. The indifference curve that describes a worker's choices between income and risk of injury must be upward sloping because risk is a "bad".

Suppose that the worker is currently at point P in the indifference curve. The only way to persuade the worker to move to the riskier job and hold her utility constant is by increasing her wage.

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 utilities if she chooses the safe job
- She **would prefer the safe job** if the risky job paid a wage of w_1' dollars. Her utility in the safe job (U_0) would then exceed her utility in the risky job (U_1')
- She **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 $\hat{w}_1$

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- **Reservation price** = the amount of money it would take her to bribe her into accepting risky job

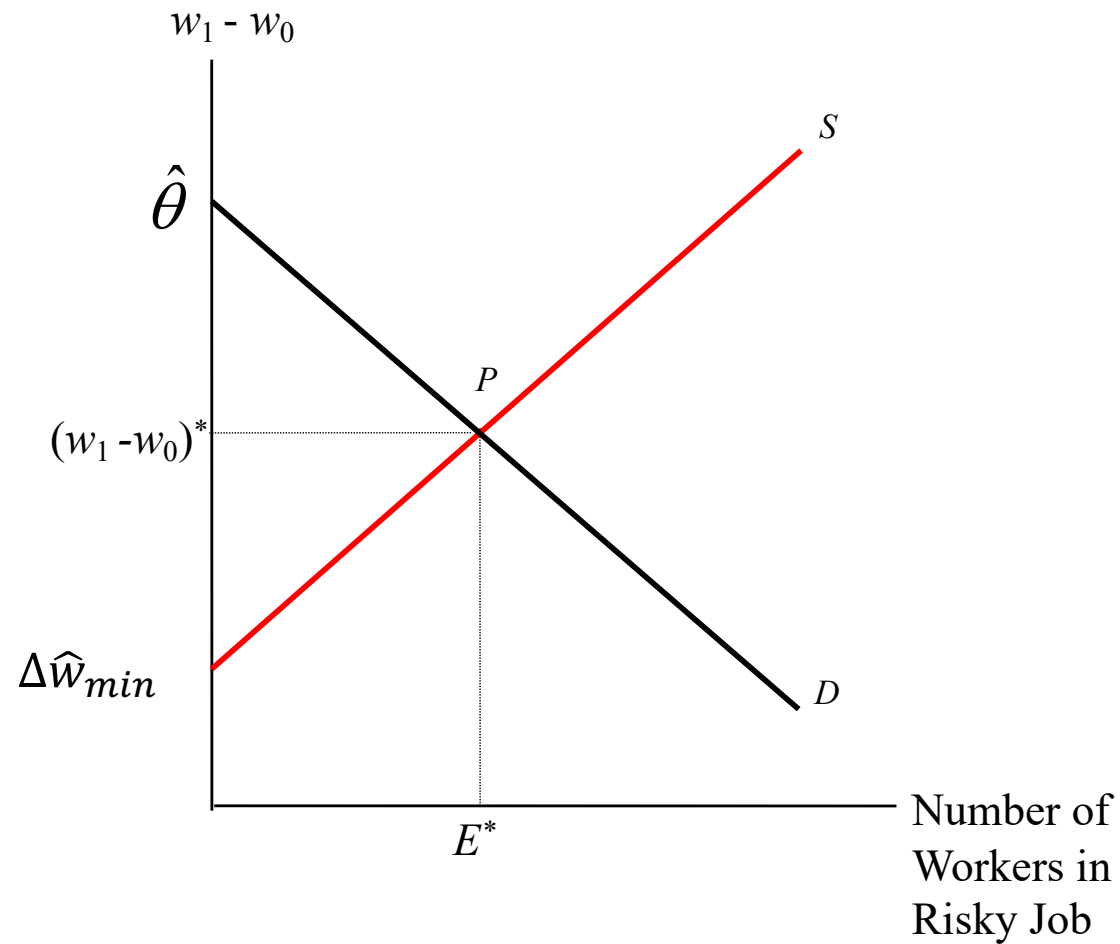
$$\Delta \hat{w} = \hat{w}_1 - w_0$$

The Supply Curve to Risky Jobs



- How many workers are willing to offer their labor to the risky jobs as a function of wage differential between the risky job and the safe job.
- We have assumed that all workers dislike risk, no worker would be willing to work at the risky job when the wage differential is zero.
- As the wage differential rises, there will come a point where the worker who dislikes risk the least is “bought off” and decides to work in the risky job.

Determining the Market Compensating Differential





The supply of labor to risky jobs slopes up because as the wage gap between the risky job and the safe job increases, more and more workers are willing to work in the risky job.

The Demand Curve for Risky Jobs



- A firm also must decide whether to provide a risky or a safe work environment to its workers.
- The firm's choice will depend on what is more profitable.
- Suppose that the firm is going to hire E^* workers regardless of which environment it chooses.

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- If the firm chooses to offer a safe work environment, the firm's production function is

$$q_0 = \alpha_0 E^*$$

The parameter α_0 gives the change in output when a safe firm hires one more worker, so that α_0 is the marginal product of labor in a safe environment.

If the price of the output equals p dollars, the value of marginal product of labor in a safe firm equals

$$p \times \alpha_0$$

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- If the firm chooses to offer a risky environment, the firm's production function is

$$q_1 = \alpha_1 E^*$$

The parameter α_1 is the marginal product of labor in a risky environment.

The value of marginal product of labor in a risky firm equals

$$p \times \alpha_1$$



The firm's profits depend on whether it offers a safe or a risky environment. The profit under each of these two possibilities are given by

$$\pi_0 = p\alpha_0 E^* - w_0 E^*$$

$$\pi_1 = p\alpha_1 E^* - w_1 E^*$$



A profit maximizing firm offers a risky environment if

$$\pi_1 > \pi_0$$

Define the difference

$$\theta = p\alpha_1 - p\alpha_0$$

as the dollar gain per worker when the firm switches from a safe environment to a risky environment



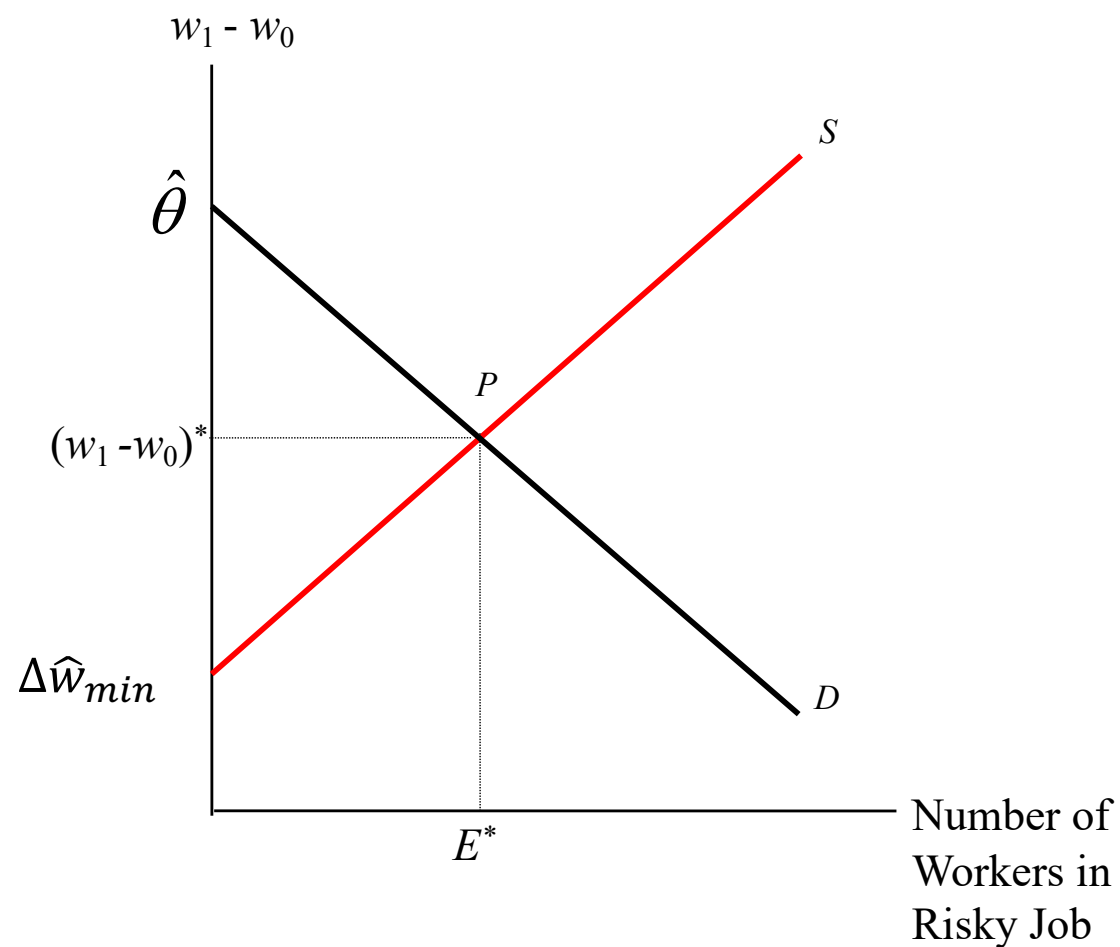
If the additional labor costs exceed the per-worker productivity gain $w_1 - w_0 > \theta$, the firm is better off by offering a safe environment.

If the additional labor costs are less than the per-worker productivity gain $w_1 - w_0 < \theta$, the firm maximizes profit by offering a risky environment.

Equilibrium

- The compensating wage differential received by workers in risky firms is $(w_1 - w_0)^*$ and E^* workers are employed in these jobs.
- Properties of the market wage differential are
 - ▣ The compensating wage differential is positive.
 - ▣ The equilibrium compensating wage differential is the wage differential that is required to attract the marginal worker into the risky job.

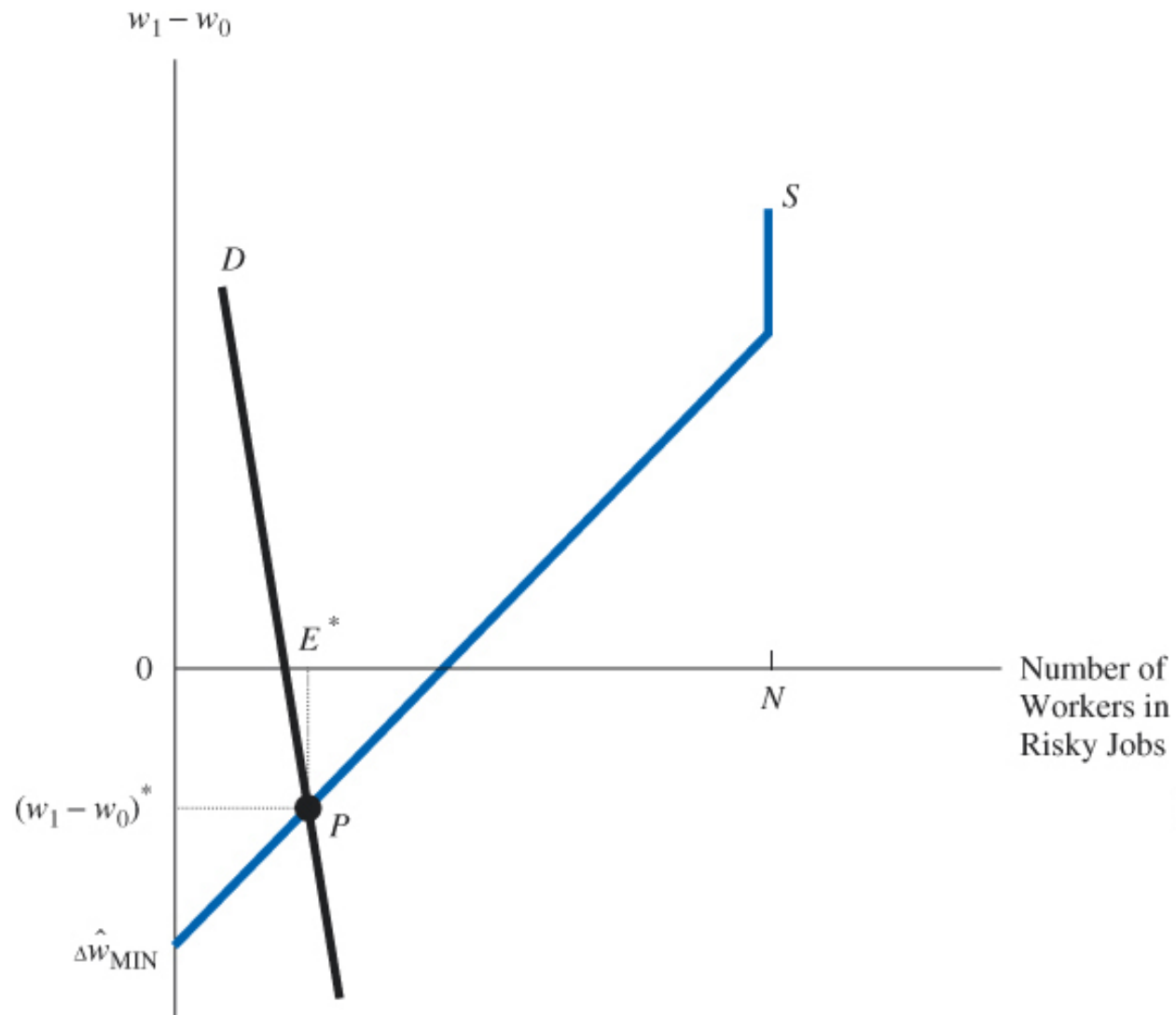
Determining the Market Compensating Differential



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- The supply of labor to risky jobs slopes up because as the wage gap between the risky job and the safe job increases, more and more workers are willing to work in the risky job.
 - The demand curve slopes down because fewer firms will offer risky working conditions if risky firms have to offer high wages to attract workers.
 - The market compensation differential equates supply and demand, and gives the “bribe” required to attract the last worker hired by risky firms.

Can the Compensating Wage Differential Go
the “Wrong” Way?

Market equilibrium when some workers prefer to work in risky jobs



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- If some workers like to work in risky jobs and if the demand for such workers is small, the market compensating differential is negative.
 - At point P, where supply equals demand, workers employed in risky jobs earn less than workers employed in safe jobs.

The Hedonic Wage Function

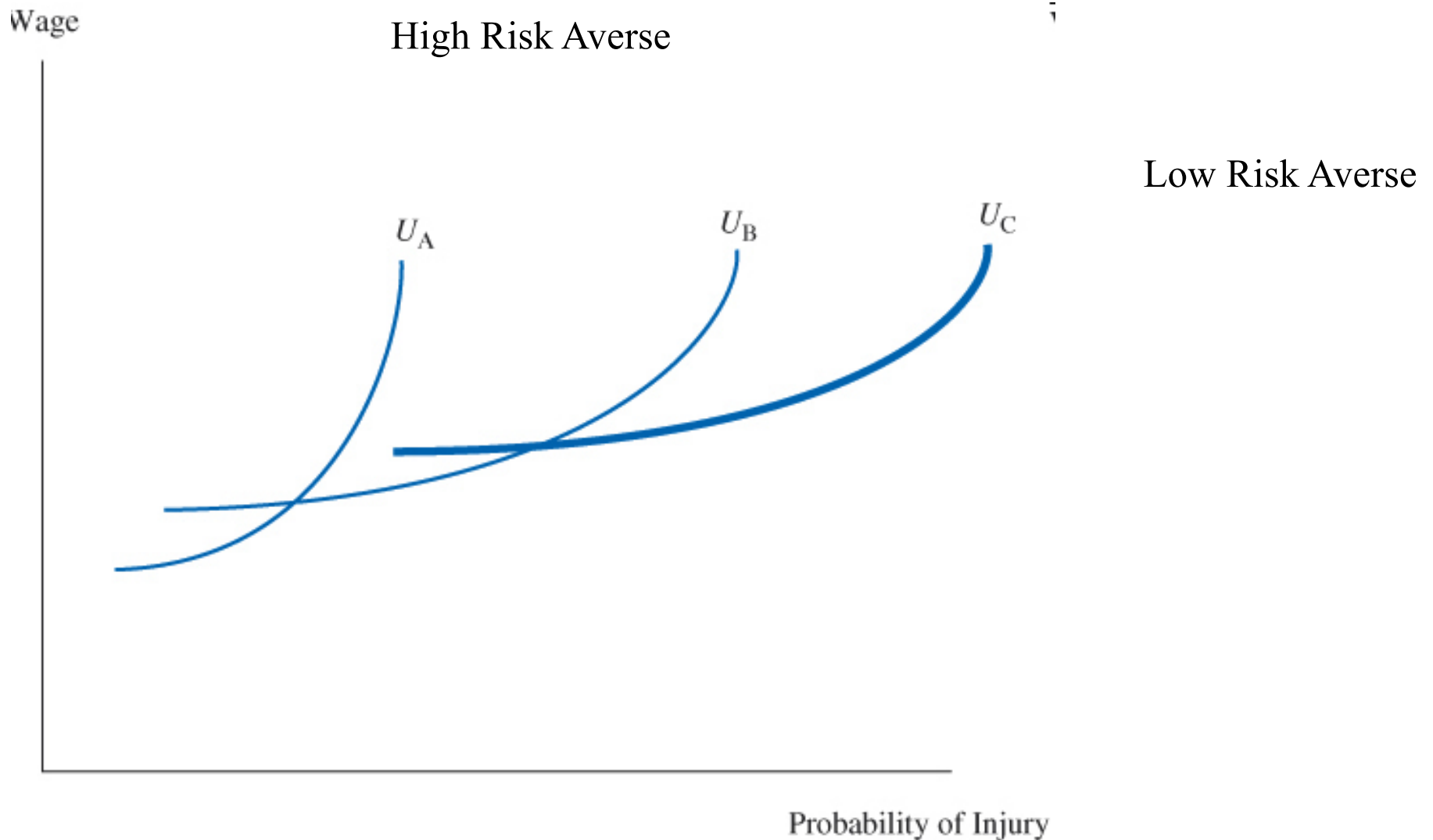


- Workers maximize utility by choosing wage-risk combinations that offer them the greatest amount of utility.
- Hedonic wage functions reflect the relationship between wages and job characteristics.



Suppose that instead of having only two types of firms, there are now many types of firms. The probability of injury on the job, which we will denote by ρ , can take on any value between 0 and 1.

Indifference Curves for Three Types of workers



Indifference Curves of Different Workers



- Different workers have different attitude toward risk → Shape of IC
- Steeper IC → High risk averse → More compensation toward risk
- Flatter IC → Low risk averse → Low compensation toward risk

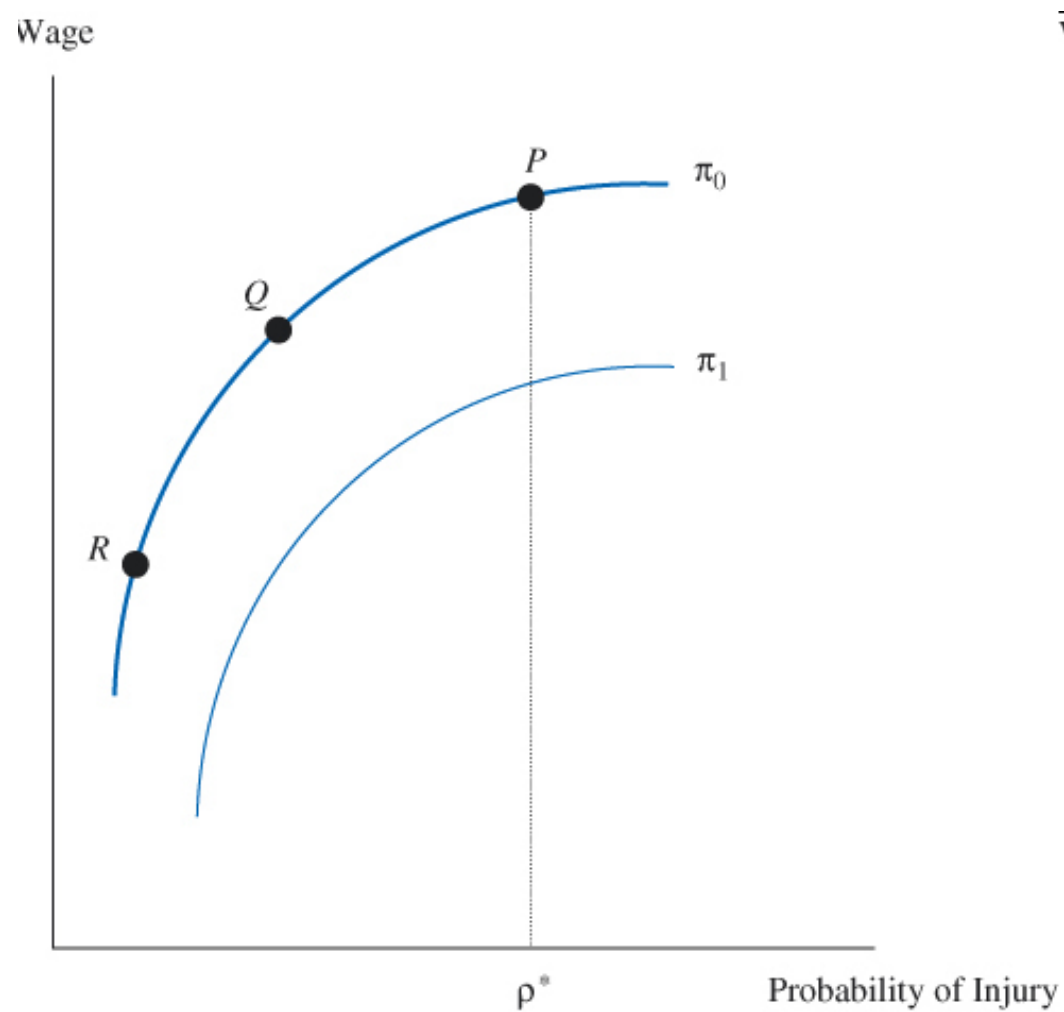
The Isoprofit Curve



Isoprofit curves have a number of important properties:

- ▣ Isoprofit curves are upward sloping because it costs money to produce safety
- ▣ Wage-Risk combinations that lie on a higher isoprofit curve yield lower profits
- ▣ Isoprofit curves are concave
 - Because production of safety is subject to the law of diminishing returns.

Isoprofit Curves



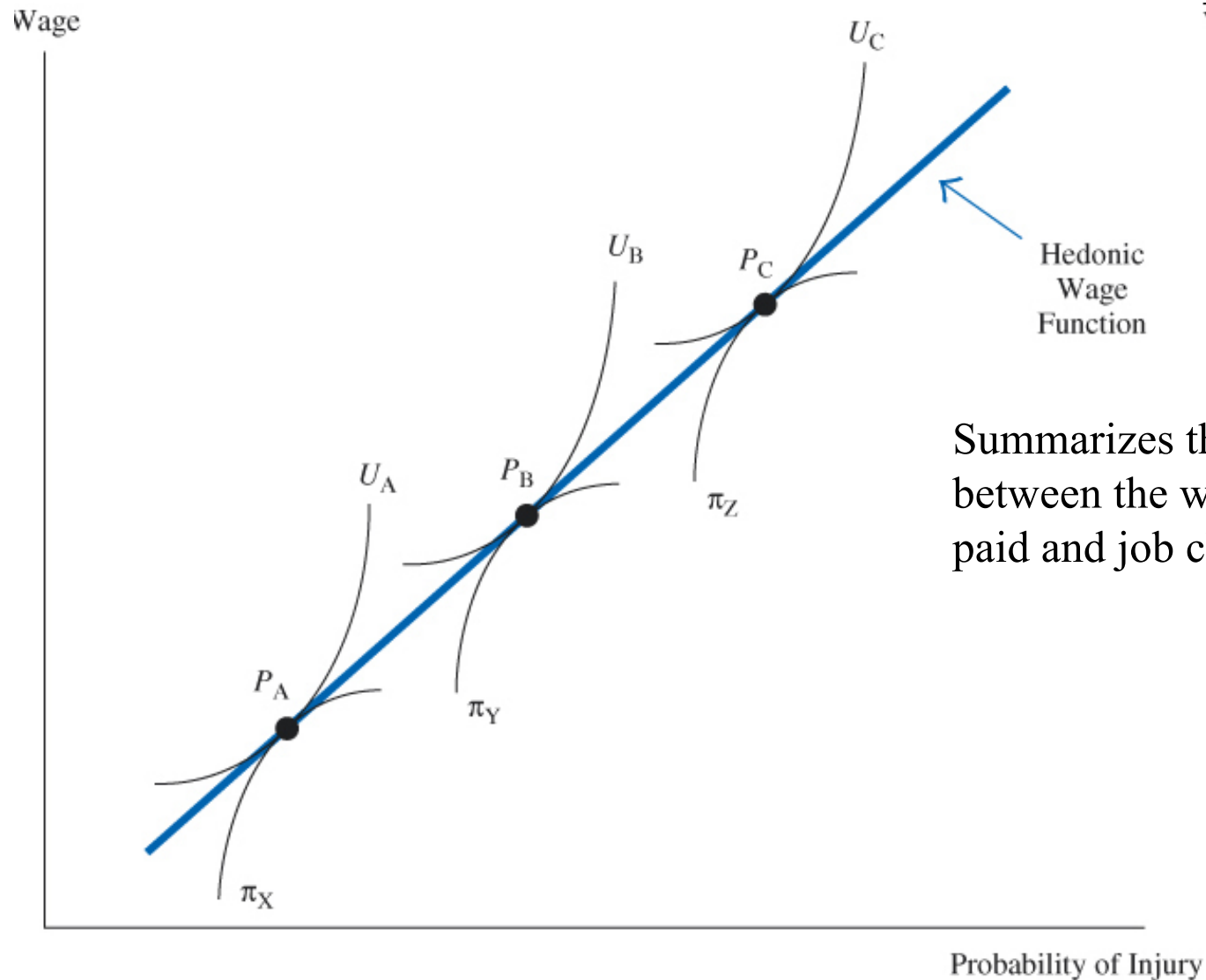
Equilibrium



Hedonic wage function

- ▣ Summarizes the relationship between the wage that workers get paid and job characteristics
- ▣ Because workers dislike risk and because it is expensive to provide safety, the hedonic wage function is upward-sloping

The Hedonic Wage Function



Summarizes the relationship between the wage that workers get paid and job characteristics

Policy Application:

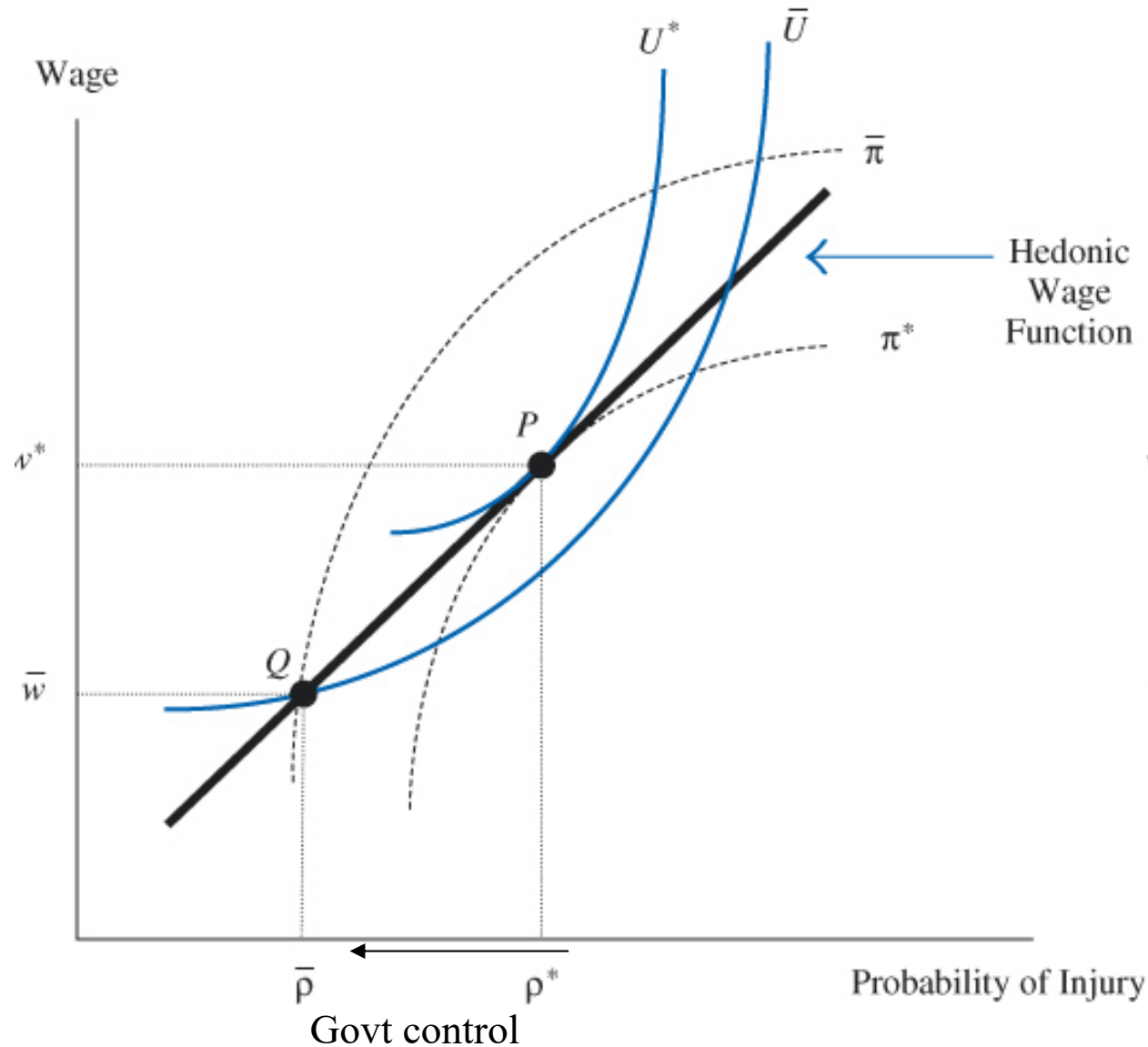
Safety and Health Regulation



- The Occupational Safety and Health Administration (OSHA) is charged with the protection and health of the American labor force.
- OSHA sets regulations that are aimed at reducing risks in the work environment.
- 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.

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- Are workers better off as a result of these regulations?
 - How do the safety standards alter the nature of the labor market equilibrium that generates compensating wage differentials?
 - Do these government mandates actually reduce the probability of injury on the job?

Impact of OSHA Regulation on Wage, Profits, and Utility

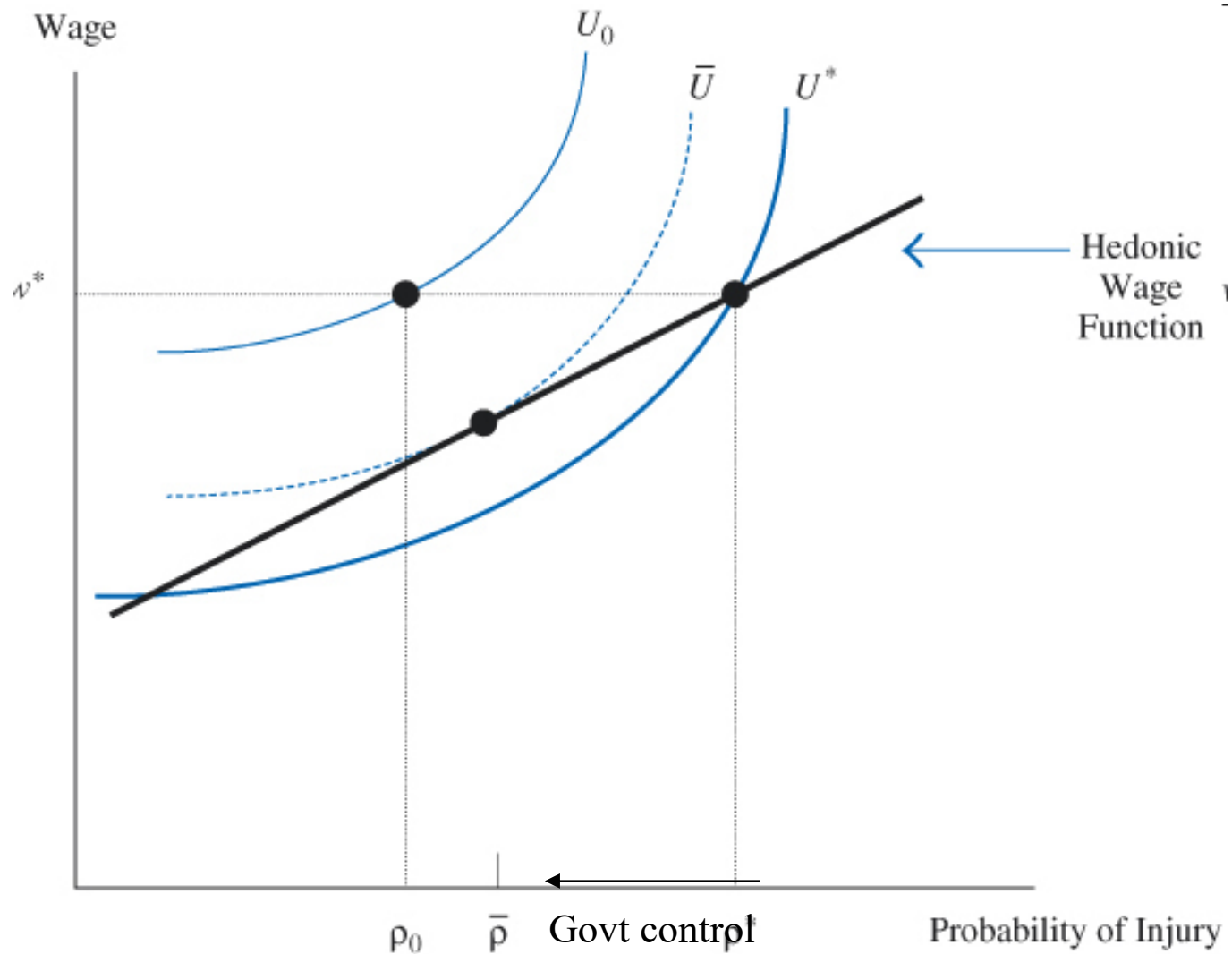


Impact of regulations when workers are unaware of the risks



Suppose the employers know full well the risks associated with the job, and that workers systematically underestimate how much risk they are being exposed to.

Impact of OSHA Regulations When Workers Misperceive Risks on the Job



Compensating Differentials and Job Amenities

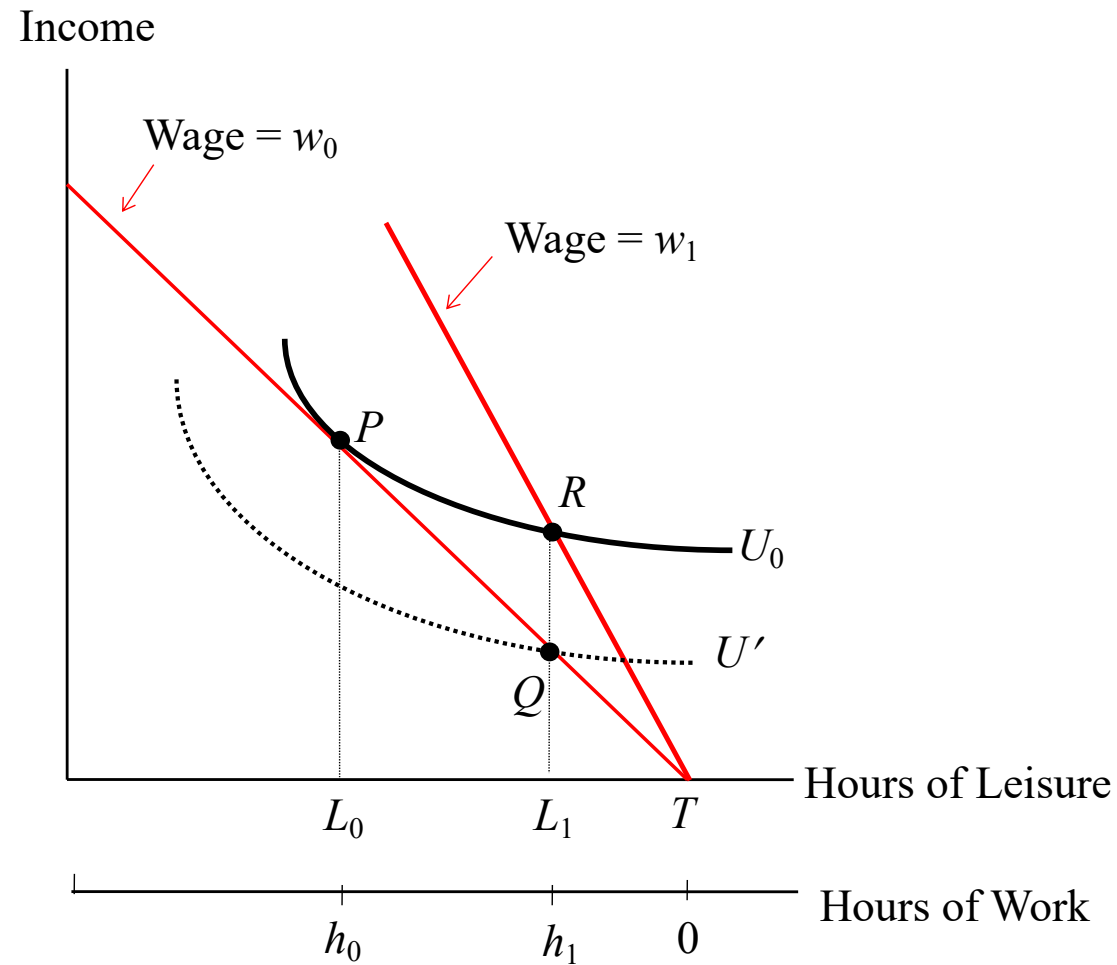
- Good job characteristics are associated with low wage rates.
- Bad job characteristics are associated with high wage rates.
 - ▣ The evidence is not clear on the link between amenities and wage differentials, except for the risk of death.
- Examples of amenities: job security, predictability of layoffs, work schedules, work hours, safety, etc.

Compensating Differentials and Layoffs

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- Unemployment insurance (UI) system is that workers need to be protected from the vagaries of the competitive labor market.
 - UI system pays a fraction of the worker's salary while the workers look for alternative employment.
 - UI stabilizes the flow of income (and consumption) for workers who are laid off from their jobs.

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- The income stabilization justification for the UI program, however, is much less appealing if the labor market, through compensating wage differentials, already compensates workers with high layoff probabilities.

Layoffs and Compensating Differentials





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 must raise the wage to w_1 so that workers will be indifferent between the two jobs.

Policy Application: Health Insurance and the Labor Market



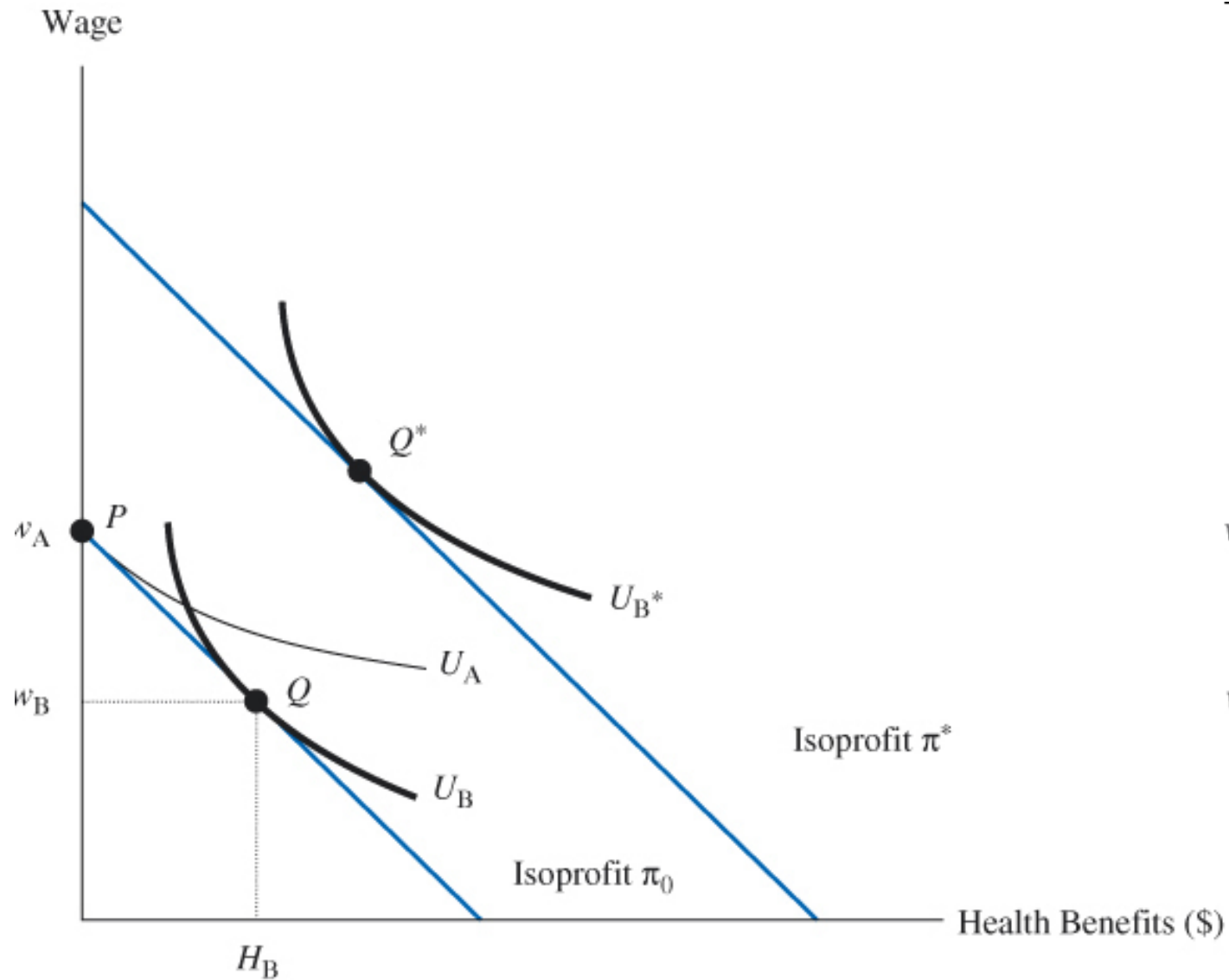
Suppose that all workers view the employer-provided program as a “good.” The worker’s indifference curve relating wages and health insurance would then have the usual downward-sloping convex shape.



Worker A has the flat indifference curve U_A ,
implying that she does not attach much value to
being covered by health insurance.

Worker B's indifference curve U_B is steeper,
implying that this worker attaches a high value to the
employer-provided insurance.

Health Benefits and Compensating Differentials



Class exercise I



Suppose there are 100 workers in the economy in which all workers must choose to work a risky or a safe job.

Worker 1's reservation price for accepting the risky job is \$1.

Worker 2's reservation price for accepting the risky job is \$2.

There are 10 risky jobs.

What is the equilibrium wage differential between safe and risky jobs? Which workers will be employed at the risky firm?

Source



Borjas, G. (2019). Labor Economics. 8th ed.
McGraw-Hill, USA.