The Compensating Differentials Model

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Outline

Supply of Workers to Jobs

Firm Side

Hedonic Price Model

Applications

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Compensating Differentials

(or equalizing differences)

In the Roy model people only care about income, but differ in skills

In the simplest version of this model people

- Have identical skills
- Heterogeneity in tastes for jobs

Basic idea is that an employer must pay a premium to get you to do some job that you don't want to do

Let D represent a disamenity of work like how dangerous it is

Suppose

- $D = 0$ represents safe jobs that pay W_0
- $D = 1$ represents dangerous jobs that pay W_1

All safe jobs will pay the same because workers are identical and the labor market is competitive (and frictionless)

Preferences

$$
\begin{aligned}
& U_i(C, D) \\
C_0 &= Y + W_0 \\
C_1 &= Y + W_1
\end{aligned}
$$

where Y is nonlabor income

Compensating difference is determined by indifferent individual

Lets figure out what the supply curve looks like

Take a really simple case with linear utility so that

$$U_i(C, D) = C - \delta_i D$$

Then individual *i* chooses to work in dangerous sector if

$$\begin{aligned} U_i(C_0, 0) &< U_i(C_1, 1) \\ Y + W_0 &< Y + W_1 - \delta_i \\ \delta_i &< W_1 - W_0 \equiv \Delta W \end{aligned}$$

For person *i* the supply curve looks like:

ΔW
δ_i
0
1
Dangerous workers

Now suppose that δ_i varies over the population with measure G

Let $1(\bullet)$ be the indicator function

Supply of people to dangerous jobs can be written as

$$\begin{aligned} N_1^s(\Delta W) &= \int 1(\delta_i < \Delta W)\, dG(\delta_i) \\ &= G(\Delta W) \end{aligned}$$

Similarly supply to safe jobs is just

$$N_0^s(\Delta W) = 1 - G(\Delta W)$$

Notice that

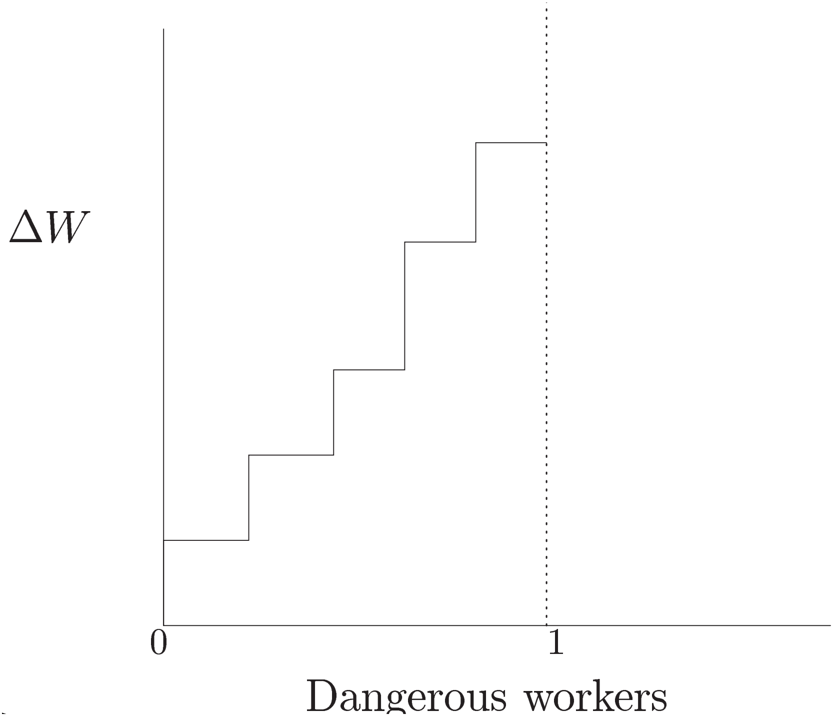
- This is just the CDF of δ_i
- As ΔW increases more people do the dangerous job
- Elasticity of supply

$$\begin{aligned}\frac{\partial \log(N_1^s(\Delta W))}{\partial \log(\Delta W)} &= \frac{\partial \log(G(\Delta W))}{\partial \log(\Delta W)} \\ &= \frac{\Delta W}{G(\Delta W)} g(\Delta W)\end{aligned}$$

so the elasticity depends on the density of people who are indifferent.

Examples:

ΔW
δ^*
0
1
Dangerous workers


ΔW
0
1
Dangerous workers


ΔW
0
1
Dangerous workers


ΔW
0
1
Dangerous Workers

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Now lets think about the firm side of the market

It costs money to make the workplace safe

The cost varies across jobs (this is easier for a university than a coal mine)

Each firm (job) hires one worker and there are as many firms as workers

Production for the firm j is F_j

Costs of making the work environment safe is β_j

so profits as a function of working environment is

$$F_j - \beta_j (1 - D) - W_D$$

Thus the workplace is dangerous if

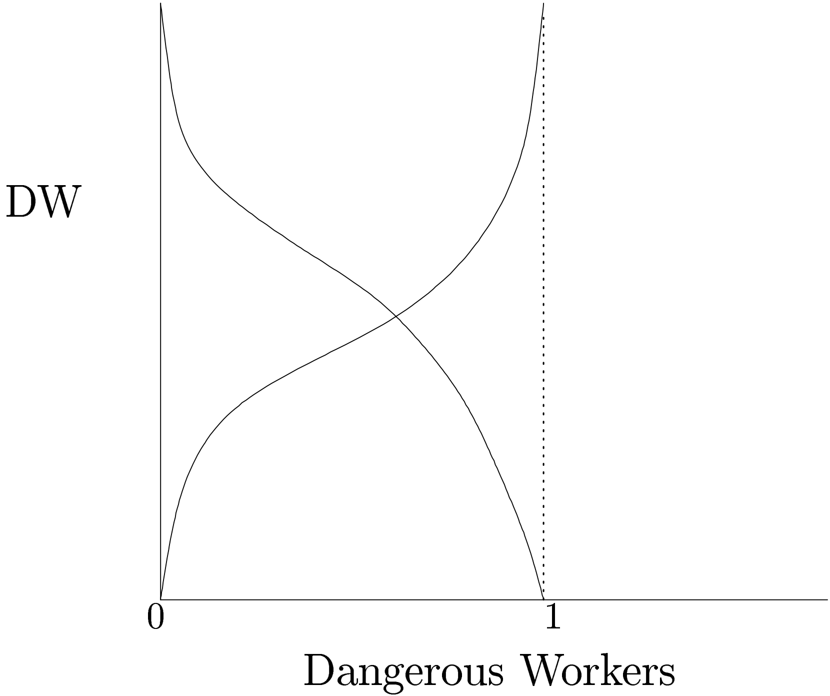
$$\begin{aligned} W_1 &< W_0 + \beta_j \\ \beta_j &> \Delta W \end{aligned}$$

Let F be the distribution of β_j then demand for workers in dangerous jobs is

$$\begin{aligned} N_1^d(\Delta W) &= \int 1(\beta_j > \Delta W)dF(\beta_j) \\ &= 1 - F(\Delta W) \end{aligned}$$

So demand also looks like a cdf.

Putting them together


DW
0
1
Dangerous Workers

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More generally suppose that danger is continuous

Let $W(D)$ be the wage paid at mortality rate D

Worker chooses D to maximize

$$U^i(Y + W(D), D)$$

so

$$U^i_c W' = -U^i_D$$

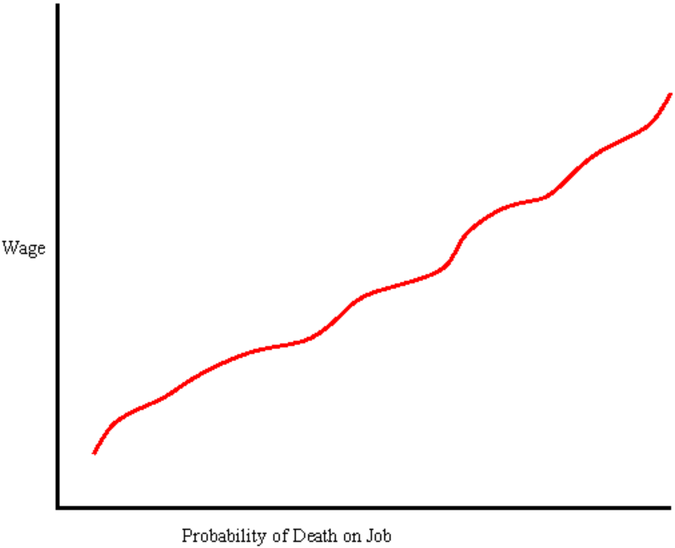
Firm minimizes costs of production

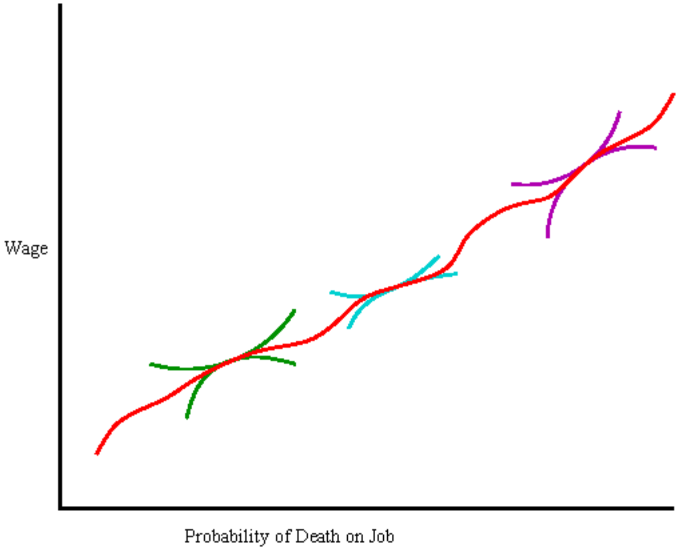
$$W(D) + \beta^j(D)$$

so

$$W' = -\beta^{j\prime}$$

I am not going to get into detail (See Rosen)


Wage
Probability of Death on Job


Wage
Probability of Death on Job

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- Occupational Choice
- Immigration/Migration
- Environment
- Local public finance
- Industry wage differences
- Human capital/Signaling
- Labor Supply