14.662 Recitation 8

Rosen (1974), Gruber (1997), and Bringing Compensating Differences to Data

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Spring 2015

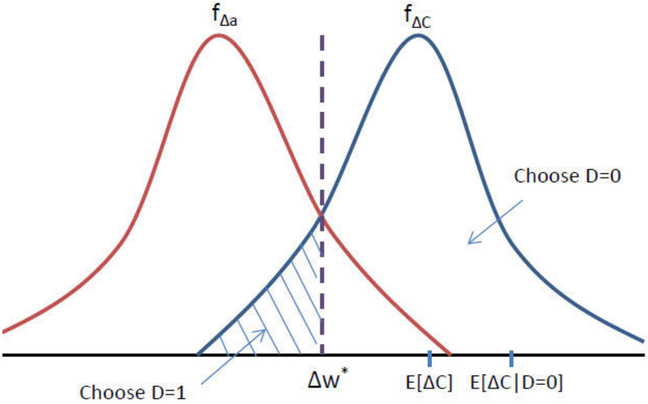
Review: Compensating Differences Intuition

- Labor market hiring a tied sale of worker's labor for job attributes
  - Heterogeneous working conditions across jobs
  - Heterogeneous worker preferences for conditions
- With Roy sorting, matches are made when (among feasible choices) workers find job attributes most beneficial and employer finds worker's characteristics most profitable
  - Total compensation: wage for labor + "wage" for job attributes
  - Eq'm wages clear market for worker characteristics and job attributes
- Very natural intuition that is easily formalized
  - In class you saw the discrete-attribute formalization (Rosen, 1986)
  - Today we'll work through the continuous model (Rosen, 1976)
- Bringing model to data is tough!
  - Unobserved worker/firm heterogeneity complicates identification (and even what we think we want to identify)

Review: Discrete Attributes Model

- Two types of jobs: $D = 0, 1$; workers heterogeneous in preferences
  - Roy selection to $D = 1$ jobs when $w_1 - w_0 > C^* - C_0$ for optimal $D = 0$ consumption C_0 and C^* satisfying $U(C^*, 1) = U(C_0, 0)$
  - $D = 1$ labor supply given wage premium: $F_{\Delta C}(\Delta w)$
- Per-worker production gain in being $D = 1$ job: $a_1 - a_0$ (CRTS)
  - $D = 1$ labor demand given wage premium: $1 - F_{\Delta a}(\Delta w)$
- Equilibrium Δw^* satisfies $F_{\Delta C}(\Delta w^*) = 1 - F_{\Delta a}(\Delta w^*)$
  - Negative assortative matching
  - Market differential reflects marginal worker/firm; others get rents
- Empirical identification of *marginal* Δw may be very differen from *average* willingness-to-pay for attributes

Review: Discrete Attribute Equilibrium



- Negative assortative matching: $E[\Delta C | D = 0] > E[\Delta C]$
- Eq'm compensating diff. understates average WTP: $\Delta w < E[\Delta C]$

Continuous Attributes: Workers

- Let D be the level of continuous disamenity (e.g. pollution)
  - Individual utility $U(C, D, \varepsilon)$ with $U_C > 0 > U_D$
  - ε denotes individual-level heterogeneity
- Define $W(D)$ as the "compensating difference function," representing the menu of wage options for a worker
  - In PF, you'd call this the "hedonic price schedule"
- With $C = W(D)$, worker solves

$$\max_D U(W(D), D, \varepsilon)$$

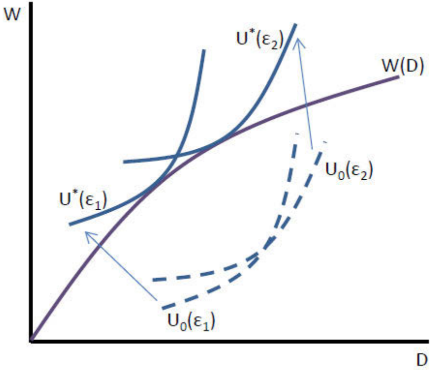
FOC:

$$U_C(C^*, D^*, \varepsilon)W'(D^*) + U_D(C^*, D^*, \varepsilon) = 0$$

$$\underbrace{-\frac{U_D(C^*, D^*, \varepsilon)}{U_C(C^*, D^*, \varepsilon)}}_{\text{MRS}} = \underbrace{W'(D^*)}_{\text{price}}$$

Graphing the Worker Solution

- Compensating difference function forms lower envelope of heterogenous workers' MRS



- Here worker 1 has a greater distaste for D ($MRS(\varepsilon_1) > MRS(\varepsilon_2)$) and in equilibrium chooses a lower D^*

Continuous Attributes: Firms

- Firms compete with CRT(worker)S production $f(D,\eta)$, with $f_D > 0$
- Solve

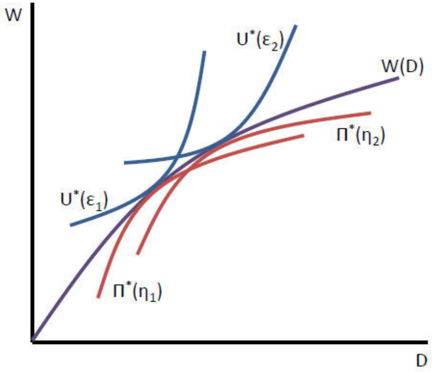
$$\max_D f(D,\eta) - W(D)$$

FOC:

$$\underbrace{f_D(D^*,\eta)}_{\text{MRTS}} = \underbrace{W'(D^*)}_{\text{price}}$$

- Compensating difference function forms upper envelope of heterogenous firms' MRTS
  - "Kissing equilibrium" yields shape of $W(D)$

Continuous Attribute Equilibrium



- Here firm 1 uses D more efficiently ($MRTS(\eta_1) > MRTS(\eta_2)$) and in equilibrium chooses a lower D^* (matched to more D-averse workers)
- Along $W(D)$ workers can't increase utility, firms can't increase profits
  - Can easily estimate equilibrium $W(D)$. What does it tell us?

Identification of Compensating Differential Frontier

- If worker MRS is homogeneous, variation in $W(D)$ driven by firm heterogeneity; slope of $W(D)$ identifies common indifference curve
  - If firm MRTS is homogeneous, variation in $W(D)$ driven by worker heterogeneity; slope of $W(D)$ identifies common isoprofit curve
- If both workers and firms are heterogeneous, $W(D)$ hard to interpret
  - Mixture of marginal preferences/costs
  - Analogous to usual demand/supply endogeneity problem
- Rosen (1974): estimate $W(D)$ parametrically, regress $\widehat{W'(D)}$, on D
  - Very unclear (to me, at least) what this actually means or when it works. See Epple (1987) and Bartik (1987) for early criticisms
- Clear that (just as in supply/demand case) we need instruments to (effectively) hold heterogeneity in one side of the market fixed
  - Doesn't seem best use of instruments has been sufficiently addressed

The Economics of Mandated Benefits

- The U.S. labor market features a wide range of employer mandates:
  - E.g. UI, workers comp., OSHA, family/medical leave, health insurance
- Many potential benefits to mandates (take 14.472 with Amy!)
  - Private market failures (e.g. adverse selection), paternalism, redistribution, merit goods...
- Incidence of benefits will depend on how much workers' value the benefits vs. how much they cost employers
  - Imposition of mandates will induce a revealing compensating differential
- Simplifies the compensating differential empirics
  - We know (in partial equilibrium, anyway) how the mandate affects firm's costs
  - Can interpret incomplete pass-through to wages to incomplete valuation by employees

Mandated Benefit Incidence (Summers, 1989)

- Labor demand $L_d(W+C)$ and supply $L_s(W+\alpha C)$ for wage W, cost of benefit C, and value of benefit to employees αC
- Can (and will, on the problem set) show:

$$\frac{\partial W}{\partial C}|_{C=0} = -\frac{\eta^d - \alpha\eta^s}{\eta^d - \eta^s}$$
$$\frac{\partial L}{\partial C}|_{C=0} = (1-\alpha)\frac{L^*}{W^*}\left(\frac{\eta^s\eta^d}{\eta^s - \eta^d}\right)$$

  where $\eta^d < 0$ is the L.D. elasticity, $\eta^s > 0$ the L.S. elasticity
- When $\alpha = 1$, all incidence is on wages; labor supply unchanged

Payroll Taxation in Chile (Gruber, 1997)

- In 1981, Chile privatized SSDI and shifted financing of other insurance programs from employer payroll taxes to general revenues.
  - Drop in average payroll tax rate for manufacturing to 8.5%
  - Want to test tax/benefit linkage: was the tax reduction passed though?
- Gruber (1997) uses survey data on manufacturing plants, 1979-1986
  - Issue: have to construct tax rates by dividing total tax bill by wages
  - Measurement error in wages will bias OLS ("division bias")
- Suppose we observe $W_{ijt} = W^*_{ijt} + h_{ijt}$ where W^*_{ijt} is wage bill of employee "type" (white/blue collar) in firm j and year t, h_{ijt} is white noise. Also observe total tax payments T_{ijt}
- Want to test $b = -1$ in:

$$\ln(W_{ijt}/E_{ijt}) = a + b\ln(T_{ijt}/W_{ijt}) + \varepsilon_{ijt}$$

$$\ln(W^*_{ijt}/E_{ijt} + h_{ijt}/E_{ijt}) = a + b\ln((T_{ijt}/W^*_{ijt})(1 - h_{ijt}/(W^*_{ijt} + h))) + \varepsilon_{ijt}$$

$\Longrightarrow$ Estimate will face negative bias

Gruber (1997) Identification: DDD and IV

- Assume spurious variation in wages is only along firm, group, year, firm×group, firm×year, and group×year dimensions, and that true correlation of taxes and wages lives in the firm×group×year dimension
- Gruber (1997) correspondingly runs a triple-diff:

$$\ln(W_{ijt}/E_{ijt}) = \beta \ln(T_{ijt}/W_{ijt}) + \alpha_i + \gamma_j + \delta_t + \mu_{ij} + \lambda_{jt} + \kappa_{it} + \varepsilon_{ijt}$$

  Or, equivalently with $T = 2$ (e.g. 1979/1980, 1984/1985)

$$\Delta \ln(W_{ij}/E_{ij}) = \delta + \beta \Delta \ln(T_{ij}/W_{ij}) + \lambda_j + \kappa_i + \Delta\varepsilon_{ij}$$

- Also runs without λ_j to include variation in the firm×year dimension, instruments T_{ij}/W_{ij} with T_{-ij}/W_{-ij} and by geographic group dummies (Angrist, 1993)

Gruber (1997) Results

Table 3
Coefficient on Contributions/Wages in Cross-Sectional Regressions

	Pooled	
	Wages	Employment
Basic differences regression	−1 120	008
	(099)	(.106)
DDD	−1.022	−.113
	(.180)	(.165)
Instrument by other group	−1.412	.131
	(.245)	(.260)
Instrumental variables by area	−1.561	−.260
	(557)	(.593)
	[40.64]	[20.62]
N	6,066	6,066

- SEs go up a lot when restricting to triple-diff variation, but estimates are similar: cannot reject null of full pass-through
- IV estimates even noisier (first-stage F: 16; over-id test rejects) ; surprisingly more negative (though not significantly)

"Conclusions"

- My (not very sophisticated) reading: still a lot of work to do in bringing compensating differentials (/hedonics more generally) to data
  - What parameters do we want to estimate with full heterogeneity?
  - What is the ideal experiment? How do we think about "general equilibrium experiments"?
  - What do we do with these estimates?
- Mandated benefit incidence simplifies the problem considerably; can effectively shut down (fully observe) heterogeneity on one side
  - Problem reduces to usual identification considerations
  - Are there other similar settings where this is true?