Graduate Labor Economics

Notes to Accompany Lecture 6: Amenities, Sorting, and Compensating Differentials

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In this lecture we'll study the economics of job amenities and the role of amenities in driving worker-firm sorting. Here, I'll focus on the classical theory of compensating wage differentials (see Rosen, 1986, for an overview), augmented with an observation about income effects in the consumption of amenities. In class, we'll discuss Mas and Pallais (2017), a frontier empirical paper that uses a field experiment to glean workers' willingness to pay for flexible work arrangements.

1 Motivation

- Are wages a sufficient statistic for job desirability? Our predonderant focus on wages and earnings masks important aspects of how workers are compensated for their efforts.
- "Amenities" are all the non-wage job characteristic that workers care about. They include fringe benefits like health insurance and 401(k) plans, objective attributes like hours, commuting time, and risk of injury, and more intangible qualities like coworkers' friendliness, scope for creativity, and sense of mission. These intangible qualities are often hard to measure, though economists have sometimes made inroads (Stern, 2004; Hoffman and Tadelis, 2018).
- Why should we care about job amenities? You may find them intrinsically interesting (as I do), but appeals to "intrinsic interest" are seldom effective sales pitches in economics: better if we can tie our questions to social welfare or to deep questions about labor markets.
    - Amenities can break the identity "w = MRPL". For example, if employers have to incur a per-worker cost b of providing amenities, then the FOC that emerges from the cost-minimization problem will set the marginal revenue product of labor equal to $w+b$. If jobs differ in the amenities they provide, then observed wages may be a problematic proxy for workers' latent skills.
    - Moreover, since job amenities are changing over time, failing to account for them might lead us to misunderstand changes in labor productivity, the returns to skill, and the effects of government policy—all of which have clear welfare implications.
    - In particular: shifts in non-wage compensation may augment or mask measured changes in wage inequality. The available evidence suggests that "compensation inequality" has risen even faster than wage inequality (Hamermesh, 1999; Pierce, 2001, 2010).

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- Specific amenities also intersect with other important topics: work schedules and commuting time affect family formation, child-rearing, and household bargaining; the task content of work affects worker health; and gender gaps in occupational choice and earnings are impacted by occupational differences in schedule flexibility (Goldin and Katz, 2011, 2016; Wasserman, 2018). As a final example, the "pricing" of on-the-job mortality risk has been used to estimate the value of a statistical life (VSL), a key parameter for assessing the costs and benefits of public policies.
- Lastly, amenities are an important basis on which particular workers are "assigned" to particular firms. Understanding the causes and consequences of patterns of worker-firm matching is a major part of the contemporary labor agenda.

- There's lots more to do here. The existing literature has often been constrained by data availability, but there is active focus on improving matters (Maestas et al., 2017, 2018), and the area seems ripe for new contributions if you can find novel data.

2 The theory of compensating differentials

2.1 Intuition/examples

- Here are the main ideas: (i) Equilibrium wages adjust to compensate workers for pleasant/unpleasant job attributes. (ii) Employers offer wage-amenity bundles that minimize their overall labor costs. (iii) Workers sort to the jobs whose wage-amenity bundles they find most appealing. (iv) Wage gaps associated with observed amenities are therefore informative about how (marginal) workers and firms value these amenities.

- Rosen (1986) describes the employment relationship as a pair of transactions: "a tied sale in which the worker simultaneously sells (rents) the services of his labor and buys the attributes of his job". Up to now, we've talking about the first of these and ignoring the second.

- Many examples come quickly to mind:
  - Coal miners make "above-average" wages given their average levels of education.
  - Pre-PhD full-time research assistants earn much less than they could in other sectors, but they develop research skills and secure letters of recommendation to graduate programs.
  - Diplomats stationed in politically unstable countries receive hazard pay.

- On the whole, however, high-paying jobs tend to come with lots of perks: health insurance, 401(k) plans, foosball tables, and scintillating coworkers. Does this falsify the idea that good pay compensates workers for bad conditions?

2.2 Basic model

- Suppose that jobs are characterized by both a wage w and an amenity a.
  - Two (equivalent) perspectives: firm pays workers a premium to accept unpleasant conditions, or worker accepts lower wages in exchange for pleasant working conditions.
  - Let's adopt the convention that amenities are desirable: amenities are things like "flexible vacation days" and "low risk of injury". (You should be comfortable with the opposite convention too.)

- Suppose there are many workers and many firms, and each firm employs a single worker. A worker of type θ has utility $u(w, a; \theta)$, and a firm of type ϕ earns profits $\pi(w, a; \phi) = y(a; \phi) - w$.
    - Note that utility and profits depend on both w and a. In particular, we'll assume that $u_w > 0$, $u_a > 0$, $\pi_w < 0$, and $\pi_a < 0$. It's costly for firms to provide better amenities, since they have to incur explicit expenses (e.g., paying health premiums) or accept lower productivity (e.g., letting workers work more slowly to reduce the risk of injury).
    - What if each firm employs more than one worker? An easy case is one where firms have CRS production technologies (and are price-takers), so that $\widetilde{\pi}(N, w, a; \phi) \equiv N\pi(w, a; \phi)$: hiring N workers at a fixed (w, a) package just yields N times the per-worker profit. One can imagine richer patterns emerging if there are economies of scale in the provision of the amenity.
    - The parameter θ governs workers' willingness to pay for the amenity, and ϕ governs firms' willingness to accept. Let's adopt the convention that a high θ means a worker values the amenity more highly, in the sense that the MRS $\frac{u_a(w,a;\theta)}{u_w(w,a;\theta)}$ is increasing in θ. Likewise, let's suppose that high-ϕ firms find it easier to offer the amenity: that is, the magnitude of π_a (which equals the negative amount $y_a(a; \phi)$) is decreasing in ϕ for all a.
    - For simplicity, let's assume that $\theta \sim F_\theta$ and $\phi \sim F_\phi$ are continuously distributed with full support over their respective domains.
- A worker's willingness to pay for an improvement in job amenity, say from a_0 to a_1, is easily expressed in terms of the utility function. Suppose that the worker can earn wage w_0 when $a = a_0$. In this case, the worker's WTP for the higher amenity is $|w^* - w_0|$, where w^* solves $u(w^*, a_1) = u(w_0, a_0)$.
- An equilibrium allocation consists of a *hedonic wage function* $w(a)$ which stipulates the wage available for a job with a given level of amenity, together with an *assignment* of workers to firms, such that all workers and firms are optimizing given the prices they face. We're interested in the properties of both the wage-amenity locus and the matching of workers to firms. To make progress here, let's suppose that a (continuously differentiable) wage frontier $w(a)$ exists and see what properties it must satisfy.
    - Clearly, we must have $w'(a) < 0$ for any job that is filled in equilibrium: otherwise, all workers in that job could deviate to a better job $a + \varepsilon$ and earn higher wages too.
    - Each worker will choose the job that maximizes her utility: $a^* \equiv \text{argmax}_a \; u(w(a), a; \theta)$. The FOC gives $u_w w'(a) + u_a = 0$, or equivalently $w'(a^*) = -\frac{u_a}{u_w}$.[1] By our convention for θ, the RHS of this equation is smaller when θ is large, implying a higher optimal choice $a^*(\theta)$. Under our convention, for any hedonic wage function, "high types" must choose a higher level of the amenity.
    - Profit maximization by the firm implies that $w'(a) = y_a(a; \phi)$. Firms will choose the level of amenity that equates the marginal cost of improvements in the amenity to the marginal increase in the factor cost (wage). High-ϕ firms will choose higher a.
    - Combining these expressions, we see that in equilibrium $\frac{u_a}{u_w} = -y_a$: workers' MRS between wages and amenities is equated to the marginal cost of improvements to a.

[1] This is similar to the standard static labor supply problem, but note that the MRS between amenities and wages is set equal to the *slope* of the hedonic wage function, not to the hourly wage itself, since the worker isn't choosing the number of hours to work.

- Rosen (1986) calls the hedonic function $w(a)$ the "kiss function", because it represents all the points of tangency between workers' indifference curves and firms' isoprofit curves. In fact, the hedonic function can be constructed as the lower envelope, in (w, a) space, of all workers' indifference curves at the equilibrium allocation (and similarly as the upper envelope of firms' equilibrium isoprofit curves). We can distinguish two special cases, then the general case:
    - If all firms are identical, then the hedonic wage function represents their shared isoprofit curve: if the homogeneous firms are willing to locate at different (w, a) pairs, then all such pairs must yield identical profits.
    - If all workers are identical, then (by the same logic) the hedonic wage function represents a worker's indifference curve.
    - In general, though, the hedonic function doesn't tell us about any individual agent's global preferences—just about local tradeoffs between wages and amenities for the particular workers and firms that choose to locate at a given point.
- In the continuous case, provided that there are firms willing to operate throughout the wage-amenity locus, every worker obtains her "bliss point" and is indifferent on the margin to small changes in working conditions offset by the local compensating differential. In the discrete case (e.g., the binary case considered by Rosen 1986), workers will typically be inframarginal.
- In the absence of frictions, the competitive equilibrium is efficient, since workers' valuations for marginal improvements in amenities are equated to the (social) cost of providing those improvements. This is a key point for policy: well-intentioned policies to improve working conditions may easily backfire.
    - Suppose the government requires all firms to provide worker safety above some minimum level $\underline{a}$. Workers optimally choosing $a^* > \underline{a}$ are unaffected by this policy, but those who prefer $a^* < \underline{a}$ will end up in safer, but lower-paying jobs: by revealed preference, they will be worse off.
    - Why might this result break down? An obvious reason is imperfect information: if workers are imperfectly informed, or inattentive, about workplace hazards, they may undervalue safety considerations (relative to their "true" utility functions) when deciding where to work. In this case, government mandates may be welfare-improving.
    - Other market failures (externalities, market power, market incompleteness, etc.) may also yield suboptimal provision of amenities by the unregulated market, again creating rationales for government intervention.
- In many real-world cases, workers' preferences for a given amenity may be correlated with profit-relevant characteristics that are difficult to observe. For example, a firm may provide discounted gym memberships not simply because by doing so it can lower wages, but also because gym memberships may attract more active/healthier employees who will yield lower health insurance premiums and perhaps be more productive on the job.

2.3 Income effects

- One important consideration here is that "richer" workers—those with higher levels of "full income", in the sense of the maximal wages they could command—may choose to convert some of their earnings potential into amenities rather than wages.
    - Basic condition: amenities are normal goods, so that workers want more of them when they are wealthier. A stronger version of this is that amenities may be superior goods (the income elasticity of demand for a given amenity is above unity), so that as full incomes rise, a rising share of income will be "spent" on amenities.
- To illustrate this idea, suppose that wages are an additive function of both education and amenities:
$$w(e, a) = v(e) + t(a),$$
with $v'(e) > 0$ and $t'(a) < 0$. Suppose for simplicity that utility is given by
$$u(w, a) = \log(w) + \log(a) = \log[v(e) + t(a)] + \log(a)$$
(The intuition is more general, but I want to get a simple analytic result.)
    - The worker chooses a to maximize utility. Her FOC gives
$$\frac{t'(a)}{v(e) + t(a)} + \frac{1}{a} = 0 \implies at'(a) + v(e) + t(a) = 0$$
    - Using the implicit function theorem, we see that $\frac{da^*}{de} = -\frac{v'(e)}{2t'(a)+at''(a)} > 0$ provided that $t''(a) < 0$, which will hold provided that the firm's marginal cost of providing the amenity is increasing in a.
- Hamermesh (1999) makes the point that, as inequality in (full) earnings rises, we are likely to see increasing inequality in amenities as well: well-off workers will translate some of their extra earnings into pleasant working conditions, obscuring the true extent of rising inequality in the returns to work. He argues empirically that this has indeed occurred in recent decades.
- Furthermore, in general equilibrium these income effects may lead to some workers ending up with *worse jobs* (in the sense of amenities) even if incomes are generally rising.
    - Suppose that there are high school and collegiate workers, and that the college graduates experience an exogenous increase in full earnings (say due to SBTC). Suppose further that there is a set of tasks in the economy that must be performed at night (e.g., 911 dispatchers, security services, inventory restocking).
    - In the new allocation, fewer college graduates will want to work night jobs (assuming, plausibly, that night-work is a disamenity), effectively reducing the supply of workers to night-shift jobs.
    - This will in turn result in a higher compensating differential for night shifts, which (through a substitution effect) will induce more high school workers to accept night-shift jobs. These workers will (at least absent informational frictions) be better off in a welfare sense, but they'll end up working crummier jobs.

3 The empirics of compensating differentials

- The traditional approach to estimating compensating differentials is to run a *hedonic wage regression*:

$$\log w_{ij} = x_i'\beta + x_j'\gamma + \varepsilon_{ij}$$

  where x_j is a vector of job characteristics (so that γ are the coefficients of interest) and x_i is a vector of worker characteristics (like education and experience) that affect wages and may be correlated with working conditions.

  - Hedonic regressions are also used in other contexts: for instance, researchers studying housing markets often run hedonic house-price regressions to account for compositional changes in the set of houses transacting at different points in time.

- These regressions often return insignificant or "wrong-signed" coefficients, which is unsurprising given the potential for omitted variable bias here. Two kinds of selection are at play:

  - Worker selection: as I argued above, (potentially unobserved) determinants of earnings are often correlated with WTP for job amenities. Better workers get better perks.
  - Job selection: Aside from worker characteristics, we would also need to control for a whole host of job characteristics that may be bundled together. Coal-mining has an above-average mortality risk, but it's also strenuous, tiring, dirty, and dark (as vividly described by Orwell, 1937). Omitting such factors will yield an upwardly biased estimate of the wage premium to mortality risk. It's hard to disentangle the bundle.

- Brown (1980) augmented the above cross-sectional specification by including worker fixed effects, which partial out any time-invariant components of both individual earnings and workers' assigned job characteristics. The estimates are identified by changes in wages and concurrent changes in job features as workers switch between occupations.

  - The FE specification may be an improvement on the pure OLS specification (though taking out individual fixed effects may exacerbate measurement error in the covariates), but even so, Brown doesn't find consistently strong evidence in favor of hedonic predictions.
  - It's safe to say that most labor economists are deeply skeptical of attempts to back out individual valuations from purely correlational hedonic models without some kind of experimental or quasi-experimental variation in job characteristics.

- Another approach is to use experimental variation to elicit workers' WTP (or firms' willingness to accept) for marginal improvements in job amenities (Mas and Pallais, 2017).

- If we do get credible estimates of WTP, the next question is whether these WTPs are truly reflective of the welfare implications of job amenities.

  - Information: do workers fully understand all attributes of a job? Plausible for some job characteristics (e.g., boss is a jerk), less plausible for others (e.g., accurate perception of occupational hazards). Prices only reflect tradeoffs as perceived by market participants.
  - Search frictions: even if workers completely understand both their own preferences and the attributes of potentially available jobs, search costs and other rigidities will still mean that many workers aren't allocated to their "dream job" at any point in time.

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