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MANUFACTURED INEQUALITY

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Remarks at the First Annual Meeting of the Society of Labor Economists, Chicago, IL, Spring 1996. I have benefitted from discussing these ideas over the years with Gary Becker, Ted Bergstrom, Kevin M. Murphy and Jose Scheinkman. Thanks are due to Derek Neal for comments on an initial draft. This paper is part of NBER's research program in Labor Studies. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

Many discrete life choices--where to live, what kind of job to hold, and consumption lifestyle--are stratified by income. Stratification and sorting often manifest state-dependent preferences in which the marginal utility of income (consumption) depends on the outcome of prior choices. For example, one can choose to live a quiet life in the country, where money buys few things, or can choose a more active and exciting lifestyle in a large city, where money has greater value because all kinds of goods are available to buy. The natural market equilibrium stratification is for rich people to live in the city, where their money has more value, and for poor people to live in the country, where money is less productive. But before location is chosen, the a priori von Neuman-Morgenstern utility function over both choices can take the Friedman-Savage form, providing pareto efficient social demands for inequality. If there is not enough inequality to produce the socially optimum stratification to begin with, inequality is socially manufactured. People voluntarily participate in gambles and lotteries in which the winners are rich and live in the exciting places and the losers are poor and choose the quiet life. There is a "natural rate of inequality."

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Manufactured Inequality

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The study of inequality is a perennial source of research and policy interest. Today increasing inequality occupies most of our attention, but not long ago increasing equality dominated the scene. Either way, the passions aroused by this subject make it easy to forget that a certain amount of income inequality is socially efficient, even when agents are initially identical in every conceivable way. I elaborate on a little known aspect of the "natural rate" of inequality in what follows.

The idea of beneficial, socially engineered inequality is not exactly news to economists. Adam Smith argued that willful investments in education and skill acquisition, not inherited differences in natural abilities, are the principle causes of wage inequality. This is a direct implication of the theory of supply. Just as prices have to cover costs to elicit supplies of ordinary goods, so wages have to compensate for the costs of acquiring

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skills. Otherwise students wouldn't have the proper economic incentives to acquire them and their quantities might be inefficiently supplied. Smith insisted that many differences in social class and status are themselves produced by the need for people to undertake human capital investments, and not the other way around.

I will not rehash this and other well known points about the connections between distribution and incentives, but instead raise a much less familiar one that appears only sporadically in the professional literature and often is a bit hard to recognize when encountered [2]. It deserves to be far better known. The point is this: Indivisibilities in labor market and other life-choices, for instance, that people live and work in only one location and not in several at once, or that students choose only one occupation and not a multitude of them, can create incentives for voluntary redistribution, for private participation in monetary gambles that create permanent differences in wealth among identical, risk averse people. These people might willfully and *selfishly* create a kind of "natural" inequality among themselves.

Such incentives arise in an important class of discrete life-choices

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2.See especially the outstanding paper by Bergstrom (1986) on occupational choice. Marshall (1984) is closely related. A location example is found in Mirrlees (1972). Recent papers by Garrett and Marshall (1993) apply the idea to educational finance. Freeman (forthcoming) offers a broader perspective.

that are highly stratified by wealth and income. Stratification of choices always manifests positive "income effects," e.g., rich people buy different kinds of goods than poor people do. Yet there is a little more to it in many life choices because the circumstances and the ex post environments associated with them affect the marginal utility of material goods--the kind that money will buy--in different ways. For instance, people who choose to live in a large city, where all varieties of goods are available to purchase, have a much greater value for money at the margin than if they lived in a remote or rural place where little is sold. Or, money has less value to a person who has joined the French Foreign Legion and is tramping around in the far off desert than had the same person chosen to become a lawyer in Paris.

These external circumstances change one's tastes, in a sense, but people making these choices know and take account of how circumstances will affect their preferences. They know they are in for a quiet life if they choose to live in the country. A better way of saying it is that preferences are state-dependent. The different utility functions the same person has in different circumstances are not capricious nor accidental, but are fully anticipated ex ante before the life-choice is made. Under certain circumstances this force can produce an *a priori* expected utility function over

income of the form postulated by Friedman and Savage, with the utility of income function concave at its extremes and convex in between. People whose incomes lie in the convex range act as risk lovers. They rationally take bets than land them ex post on one of the more extreme concave portions of their utility functions and voluntarily manufacture an increase in the inequality of income in that range.

The point is best illustrated by a simple example. I have chosen one that is related to the classic labor economics problem of the relationship between wages and city size. On average, people who live in rural areas have lower living standards than people who live in large cities (Fuchs, 1967). Perhaps these differences reflect the disutility of urban life (Nordhaus and Tobin, 1972), but if so, why has non-urban life all but disappeared? The equalization or compensation principle does not apply so straight-forwardly here because material goods are in such limited supply in rural locales. Life is more "boring" there: money has much less spending value than in a large urban place, for reasons mentioned above.

Think of choice of locale as a two-step process. First, people make the indivisible choice of where to locate. Then they make divisible choices of how to spend their money. Wealthier people are naturally attracted to locales where money is more valuable, for they have a comparative advan-

tage at spending. Gambling offers people with less income a chance to gain comparative advantage at spending! People might prefer to willfully create income differences in which everyone knows the losers will voluntarily go to the boring places, where money is less useful and they have less of it, and the winners will go to the "interesting" places where it is more valuable.

Assume that preferences take the form $u(c,z) = c^{\gamma}z$, where z is the quality of one's place of residence, c is consumption of material goods (income), and $0 < \gamma < 1$, so that the person is risk averse in the expected utility sense, given z. It is crucial that the marginal utility of consumption, $\gamma z c^{\gamma-1}$, is larger in better locations. Assume two locations, z_l and z_h, with $z_l < z_h$. The better location is limited in supply and sites are available in a competitive market at price r_h. Sites at the low quality location are in unlimited supply and sell for a competitive market price of zero, $r_l = 0$.

A person chooses the location with the largest indirect utility, which is $u_j = (y - r_j)^{\gamma} z_j$ for j = l,h in this case. Define the reservation price r* as the value of r_h that makes the person indifferent between the two locations. Equal indirect utility in both locations implies that $r^* = y[1 - (z_h/z_l)^{-1/\gamma}]$ is an increasing function of y. People choose z_h or z_l according to whether their value of r* is greater than or less than the market price r_h. Assume y is distributed as F(y). Then the fraction of the population desir-

ing to live at z_h is $1-F(r_h/[1 - (z_h/z_l)^{-1/\gamma}])$. This is the percentage of people whose income exceeds $r_h/[1 - (z_h/z_l)^{-1/\gamma}]$. If the number of desirable locations is limited and only a fraction k of the population can live there, the market equilibrium must equate demand and supply at rent $r_h = [1 - (z_h/z_l)^{-1/\gamma}]F^{-1}(1-k)$. Market rent is decreasing in k, and increasing in (z_h/z_l) and in the mean of y. Residential choice is completely stratified by income in this economy. Everyone above the kth percentile of the income distribution lives at z_h and everyone below the kth percentile lives at z_l.

Analysis does not stop here. There may exist further gains from an unusual kind of trade. Figure 1 depicts the indirect utility functions in the equilibrium described above. Different values of r_h shift the indirect utility function for income, c, conditional on z_h and change the intersection of the two (conditional) functions. This affects the critical value of income at the kth percentile that partitions the population between the two locations. A person's unconditional von Neuman-Morgenstern utility function over income is the upper envelope of the two curves and it isn't everywhere concave.

Anybody whose income is near y^k in figure 1 is effectively risk loving and will accept certain unfair gambles. If actuarially fair (no-load) gambles were available, all those whose initial income lay between y_0 and y_1

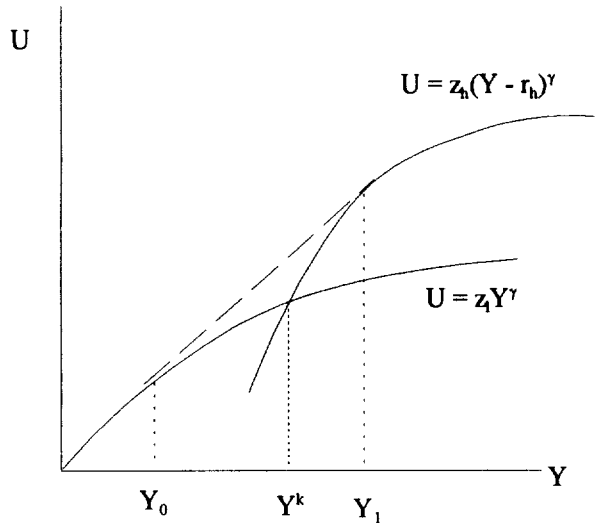

Figure 1

make bets that ultimately land them at one of those two incomes, with the amount wagered depending on the precise location of the initial income in that interval. All initial income distributions with positive mass between y_0 and y_1 in this economy provoke financial gambles until that portion of the income distribution is redistributed and massed on the two extremes, with nothing in between (c.f., Friedman, 1953).[3] The losers of these gambles voluntarily choose to live in the worse location, because, as shown above, their utility conditional on that income is largest at z_l. The winners chose to

3. Generally these redistributions will change the equilibrium rent and shift the equilibrium envelope. However, the resulting equilibrium will be of the form depicted in the figure.

live in the better environment, where spending is more productive. In effect, gambling is socially productive in providing possibilities for living on the more desirable high rent properties and raising the marginal utility of income.

Had the initial distribution of income been empty between y_0 and y_1 (including more spread out than that), there would be no demand for gambling because the income distribution is sufficiently heterogeneous on its own to achieve the equilibrium amount of stratification. In other words, these voluntary redistributions put a lower bound on the observed amount of stratification----of rich people living in the good places and poor people living in the less good places. People voluntarily engage in subsidiary redistributive actions that *create* stratification if there is not enough in the first instance.

Notice that after the cards have been dealt and all bets have been settled everyone is bound by their ex post conditional utility function on their given location. All behave as if they are risk averse, e.g., they willingly purchase actuarially unfair insurance for their possessions. State-dependent preferences and indivisibilities solve the gambling-insurance paradox by producing an overall Friedman-Savage utility function from a more fundamental argument.

Because it is a little confusing in some of the literature, notice that these gambles and redistributions never eliminate the observed "equalizing difference" in rent between the good and bad locations:[4] $r_h > 0$ always. In spatial equilibrium models the price gradient between adjacent points always reflects the marginal value of the attribute to the person who chooses that location (Rosen, 1974). In this example no one is marginal because there is hole in the income distribution between y_0 and y_1. But by revealed preference, we are always entitled to say that the observed market price r_h serves as a lower bound for the reservation value of the (richer) people actually found at z_h and it serves as an upper bound for the value (poorer) people found at z_l would pay. This statement is independent of how the income distribution evolved, and whether observed (ex post) incomes differences were "endowed" or whether they were previously "manufactured" by prior gambles.

The idea illustrated here is a practical manifestation of how randomization convexifies choice sets in the presence of indivisibilities. Some years ago Ng (1965) noted that state run lotteries then found mostly in underdeveloped countries served as a social mechanism for enabling some

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4. Or in skill-adjusted wage differences between good and bad jobs for that matter.

people to purchase large (indivisible) consumer items, like cars, that cost so much more than their incomes that they would not otherwise be available to them. Even in rich countries it is mostly poor people who participate in lotteries. The point generalizes to any situation when the marginal utility of income depends on (indivisible) external circumstances that can be affected by choice. Notice that the idea illustrated here is conceptually distinct from snob effects, social interactions and other externalities in preferences that are known to provoke risk preference (Gregory, 1980; Brenner, 1983). Gambling is strictly a private "income effect" here, though I would not be surprised if someday a deeper analysis of preferences and income effects of this kind linked the private and social-interaction incentives for gambling more closely than is possible right now. That will become clearer as we begin to spell out the class of decisions for which these kinds of considerations might apply.

The scope and limitations of this kind of analysis are unsettled so far. Certainly indivisibility---that a person chooses only one out of several alternatives and not many at once---is necessary for this effect to operate. However, the example may give the impression that the discreteness of the choice set is also essential. This is not so. Add a third, intermediate quality site z_m. Assume z_m is sufficiently limited in supply that people have to live

at all three sites. Then the rent on z_m is positive and $r_m < r_h$ in the competitive equilibrium. The market assignment of land remains completely stratified by personal income, with the cut points determined so that the percentiles of the income distribution line up with the same percentiles of the distribution of land abilities by quality. The envelope now consists of three conditional functions and the convex intervals between adjacent pairs are smaller than in figure 1. These local scallops disappear in the limit when the distribution of site quality is continuous. Nevertheless, the envelope may still be globally convex, as in figure 2, and provoke gambles. This depends on the specifics of distribution of sites relative to the distribution of income, as well as on the utility function and remains to be fully worked out.[5]

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5. If site quality is continuously distributed, equilibrium rent is r(z) and the market produces a "hedonic" equilibrium of the kind described by Rosen (1974). With identical preferences in z and c, stratification of the assignment to z by y remains complete. The equilibrium (envelope) indirect utility function need be neither concave nor convex in y for arbitrary distributions of y and z. However, after all bets have been resolved in the second-stage redistribution, the envelope must be weakly concave, as is figure 1, with possible linear segments. There are holes in those parts of the income distribution where the marginal utility of income is constant, as in the binary example. The equilibrium rent gradient and the income distribution adjust to make this happen. If the initial income distribution and site market equilibrium produces a strictly concave indirect utility function, gambling and redistribution does not occur.

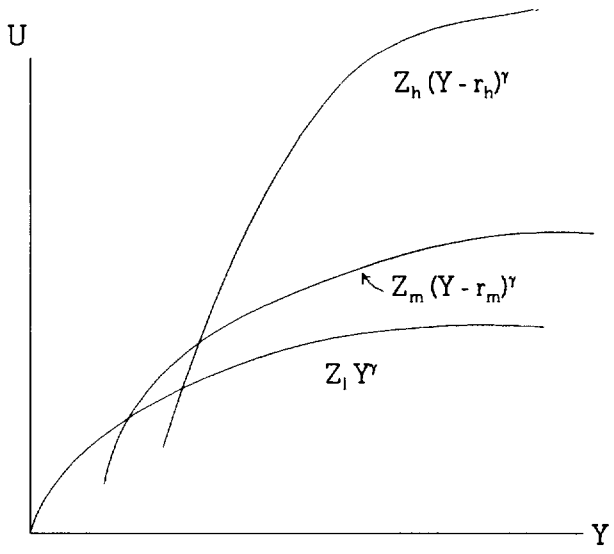

Figure 2

The analysis also needs to be extended to intertemporal environments. For instance, incentives to participate in lotteries for durable goods purchases and like would appear to be substantially lessened by well functioning capital markets that allow people to bring their lifetime resources to bear on their decisions, not only their current incomes. Hire-purchase and other loan mechanisms make ordinary durable goods purchases accessible to people of relatively modest means without gambling in rich countries such as the U.S. The gambling alternative is more interesting in poor countries where these institutions are not so well developed. More generally, some aspects of gambling probably arise to overcome ubiquitous

"human capital market imperfections," but disappear as people become richer and those imperfections become less constraining on the average person.

Most economic analysis of risk concerns itself with stochastic elements inherent in production and other economic activities. Preoccupation with insurance in the economics of uncertainty is based on the premise that intrinsic stochastic elements make our fortunes sufficiently risky that socially engineered mechanisms that add noise to essentially deterministic situations are largely superfluous. Nonetheless, significant amounts of gambling occur in all societies. To what extent is it connected to occupational, locational choices and other life-style choices? Maybe we should take greater pains to find out and think about its possible empirical implications.

References

Bergstrom, Theodore. "Soldiers of Fortune?" In Walter P. Heller and Ross M. Starr (eds) Essays in Honor of Kenneth J. Arrow, Vol.2: Equilibrium Analysis Cambridge, 1986: pp. 57-80

Brenner, Reuven, History, the human gamble. Chicago : University of Chicago Press, 1983.

Freeman, Scott, "Equilibrium Income Inequality among Identical Agents," J.of Political Economy, forthcoming

Friedman, Milton, "Choice, Chance, and the Personal Distribution of Income," Journal of Political Economy 61 (1953): 277-290.

Fuchs, Victor, "Differentials in Hourly Earnings by Region and City Size," National Bureau of Economic Research, Occ. Paper 101, New York, 1967

Garret, Rod and John M. Marshall, "Public Finance of Private Goods: The case of Public Education," J.of Political Economy 102 (1993):566-82.

Gregory, Nathaniel, "Relative Wealth and Risk Taking: A Short Note on the Friedman-Savage Utility Function," J.of Pol.Econ. 88 (1980): 1226-30.

Marshall, John, "Gambles and the Shadow Price of Death," American Economic Review 74 (1984): 73-86.

Mirrlees, James, "The Optimal Town," Swedish Journal of Economics (1972):111-35.

Nordhaus, William and James Tobin, "Is Growth Obsolete?" in National Bureau of Economic Research, Economic Growth. New York, 1972.

Ng, Yew-Kwang, "Why do People Buy Lottery Tickets? Choices Involving Risk and the Indivisibility of Expenditure," J. Pol Econ 65 (1965): 530-35

Rosen, Sherwin, "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," J Pol Econ 82 (1974):34-55.