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THE ECONOMICS OF CASTE AND OF THE RAT RACE AND OTHER WOEFUL TALES*

GEORGE AKERLOF

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I. INTRODUCTION

There is a standard model of economic behavior, the Arrow-Debreu general equilibrium model of perfect competition. While this model may not be entirely adequate as a description of economic reality, it is most useful as a standard of comparison. For in equilibrium in this model, subject to the careful qualifications of Pareto optimality, peoples' lives are as pleasurable as they possibly can be, given their tastes and productive capabilities. Consequently, to understand why peoples' lives are not as pleasurable as they might be (in the Pareto sense), it is necessary only to know why the real world fails to correspond to the Arrow-Debreu utopia.

In the real world, contrary to the assumptions of Arrow and Debreu, information is neither complete nor costless.¹ On the contrary, given the cost of information and the need for it, people typically make predictions about the behavior of the economy and the behavior of individuals based upon a limited number of easily observable characteristics. We say that such a prediction is based upon an *indicator*; an econometrician would call it a prediction using the method of instrumental variables. This paper shows the distortions caused to examples of the A-D (Arrow-Debreu) model by the introduction of *indicators*.

* The original version of this paper was written in the summer of 1971 and presented in seminars at Nuffield College, Oxford and Essex Universities. Sections I, II, III, and IV are taken from that original paper. Since that time some of this work has been duplicated. See Michael Spence, "Job Market Signaling," this *Journal*, LXXXVII (Aug. 1973), 355–79. Section V, on the theory of caste and its applications, was written in the summer of 1975. The author would like to thank Marcelle Arak and Daniel McFadden for valuable help and the National Science Foundation for financial support. He would also especially like to thank Michael Rothschild, the Guest Editor of this Symposium, for his many invaluable editorial comments.

1. Other approaches to the difficulties encountered by the A-D model in explaining labor markets are given by the "new" labor economics. See, for example, Doeringer, P. B. and Piore, M., *Internal Labor Markets and Manpower Analysis* (Lexington, Mass.: Heath, 1971); G. Becker, *Human Capital* (New York: Columbia University Press, 1964); and E. S. Phelps, *et al.*, *The Macroeconomic Foundations of Employment and Inflation Theory* (New York: W. W. Norton, 1970).

There are two types of examples of the use of *indicators* in the models that follow. One sort of *indicator* owes its existence to the potentially useful economic information provided. In the example of *sharecropping* the output produced is used as *indicator*; it serves the useful function of differentiating between farmers who have expended different levels of effort in tilling the crop. In the example of *work conditions* the speed of the assembly line predicts the ability of workers on that assembly line, and therefore differentiates workers of different ability. In contrast, in the following two examples the *indicators* owe their existence purely to social convention. In the example of *statistical discrimination*, under conditions described, all persons of the same race are predicted to have equal ability. In the example of caste the behavior of one member of society toward another is predicted by their respective caste statuses.

In this second type of example, introduction of *indicators* into the A-D model brings with it a second previously missing aspect of reality, the panoply of cultural characteristics used by anthropologists and sociologists to describe a society. For, by definition, culture consists of “regularities in the behavior, internal and external, of the members of a society, excluding those regularities which are purely hereditary.”² Since culture concerns regularities in behavior and since subcultural membership is easy to observe, members of society, as well as visiting anthropologists and sociologists, can predict individual behavior from subcultural membership. By definition, such predictions are based on *indicators*, typical examples being predictions of behavior or ability of an individual based on his caste, class, race, sex, organizational membership, religion, friends, possessions, personal appearance, or job.

The examples are presented in detail below; each one shows the possibility, given the values of the members of the society, of an equilibrium that is not Pareto optimal. But before this presentation, we should also mention, at least parenthetically, another role of *indicators* in shaping society. The *indicators* by which men judge each other may warp their values and distort their goals. The anthropologists give accounts such as those of the Kwakiutl Indians, among whom the chief at feast-time who burned the greatest number of blankets, as the mark of the most conspicuous consumption, received

2. Quoted by Arnold Toynbee, *A Study of History, A New Edition, Revised and Abridged* (London: Oxford University Press, 1972), p. 43; from P. Bagby, *Culture and History* (London: Longmans), pp. 84 and 95.

the greatest honor.³ The economists Galbraith and Veblen see similarity in our own consumption rites.⁴

II. SHARECROPPING

The first example of *indicators* deals with the simplest phenomenon. Several economists have asked why sharecropping is a common form of land system.⁵ After all, since the sharecropper is much poorer than the landlord and much less liquid as well (not owning land that can be mortgaged), it would be more natural for the landlord rather than the tenant to bear the risk of crop failure. This would be accomplished if the landlord paid the tenant a wage and sold the crops (perhaps even selling some of it back to the tenant).

There is also evidence that fixed wage payments are more "natural" than sharecropping. A recent study of sharecropping in the United States South concludes that immediately following the Civil War "the wage payment system was, from all indications universally attempted."⁶ Travelers' accounts seem to show that at the end of the Civil War sharecropping was viewed as an "experiment."⁷

There is, however, a very simple reason for a preference for sharecropping over a wage-payment system. There are two components to the sharecropper's input: the time he puts in and the effort expended. While the first is easy to observe, and can be paid a fixed wage, the second cannot be observed without careful supervision of the labor.

Suppose that the input of the sharecropper depends upon his time at work and his effort; suppose further that his effort can be measured and called e . With a wage system the sharecropper should receive an income w dependent on e and t :

$$w = w(e, t).$$

Without supervision the landlord cannot determine the effort put in; and the wage paid to the individual worker will depend on the average effort of the average worker, \bar{e} : thus

3. Benedict, R., *Patterns of Culture* (Boston: Houghton Mifflin Co., 1944).

4. Veblen, T., *The Theory of the Leisure Class* (New York: Modern Library, 1934); and J. K. Galbraith, *The Affluent Society* (Boston: Houghton Mifflin Co., 1958).

5. Cheung, S. N. S., "Private Property Rights and Sharecropping," *Journal of Political Economy*, LXXVI (Nov./Dec. 1968), 1107-22. For an approach similar to that taken here, see J. E. Stiglitz, "Incentives and Risk in Sharecropping," *Review of Economic Studies*, XLI (April 1974), 219-58.

6. Ransom, R. and Sutch, R., *What Was Freedom's Price?* (New York: Cambridge University Press, forthcoming), Ch. 4.

7. *Ibid.*, Ch. 5.

$$w = w(\bar{e}, t).$$

This leaves no incentive to the worker for any effort beyond the minimum necessary to be paid for his time. If he dislikes effort, he will minimize it.

In contrast, in sharecropping, the farmer is paid for the effort that he puts in as well as for his time; but this effort and time are estimated imperfectly from another characteristic—the output produced. The equilibrium is distorted by this procedure, since the risk-averse farmer remains unprotected from the natural randomness inherent in agriculture.

The basic stylized facts of this model conform with the conditions of sharecropping. In traditional agriculture the hard-working farmer usually receives yields that are considerably greater than the yields of the average farmer. A Punjabi peasant, who prided himself on yields greater than those of his neighbors, once listed for me “the seven things which a good farmer does, which a poor farmer does not do.” It is significant that many of these seven things involve arduous work and much patience; many are also difficult to observe.⁸ A similar story has been told by John Mellor in his study of farms in a village of Uttar Pradesh.⁹ Hard work generated significantly higher yields even with the use of only traditional farming methods.

The division of crops between those grown on a wage-payment system and those grown on shares is also consistent with our explanation. Where supervision is needed for reasons other than determination of effort, the model predicts that wages rather than shares will be paid. In India, for example, as an excellent rule of thumb, capital-intensive plantation crops are grown on a wage-payment system.¹⁰ And these crops need supervision to insure proper cultivation.

8. The list included the following:

1. Planting on time.
2. Using the proper inputs—seeds, fertilizers.
3. Smoothing the ground carefully before sowing, both to preserve moisture and to make irrigation easier; this involved going over the fields as many as five times with a bullock and plowboard.
4. Drilling the seed to the right depth and planting in straight lines with rows of proper width. This also involved hard work with a wooden plow and considerable manual dexterity.
5. Irrigation and proper use of water.
6. Weeding often.
7. Harvesting quickly.

9. Mellor, J., *The Economics of Agricultural Development* (Ithaca, N.Y.: Cornell University Press,), Ch. 8.

10. Buchanan, D. H., *The Development of Capitalist Enterprise in India* (New York: Macmillan, 1934).

III. WORK CONDITIONS: THE RAT RACE

The second example of the use of *indicators* concerns the choice of occupation and work conditions for the selection of workers. Workers who are willing to work at a fast speed (or, equivalently for the model, under difficult work conditions) are judged to have superior abilities. The model is a complicated analog of the rat race. In the rat race the chances of getting the cheese increase with the speed of the rat, although no additional cheese is produced. In our model, unlike the rat race, workers produce more output at faster speeds; but, like the rat race, the private return for additional speed exceeds the additional output produced (faster speed results in a higher wage to the individual, not only from the return from his added production, but also because of the greater estimate of his individual ability). Furthermore, as in the rat race, the individual worker is goaded on by the knowledge that at slower speeds he must share his output with workers of lesser ability (being judged the same); similarly, he is spurred on by the knowledge that at faster speeds he will share the output of workers of greater ability.

“Speed” in our model stands for “work conditions” and educational attainment.¹¹ In real life, wage differentials do induce persons to work under harder working conditions, and also to increase their levels of education. Likewise, it is also plausible that workers’ willingness to work under harsh conditions or to obtain education is correlated positively with their productivity. (In some professions this could be reversed; good workers may demand good work conditions so that they can perform their task more satisfactorily. Perhaps chess is an example.)

A model is made to illustrate these points in the following way: good workers have a greater tolerance for poor working conditions than poor workers. Surrealistically, we picture all workers at work on some assembly line; the assembly lines, however, can work at different speeds—with three consequences: (1) the faster assembly lines require harder work and are therefore distasteful; (2) faster assembly lines produce more output; and (3) workers are faceless and nameless (in our surrealistic picture). The organization that runs the assembly line cannot tell the difference between good and bad workers, but it can perceive the average difference in quality of workers who adhere to assembly lines working at different speeds. Note that the assumption is quite realistic if unions or feelings of fairness severely restrict firms’

11. The role of education in screening is mentioned by T. W. Schultz, *The Economic Value of Education* (New York: Columbia University Press, 1964).

ability to treat workers on an assembly line according to their real merit.

In our model there are N different classes of workers, numbered from 1 to N . All classes have equal population. The utility of workers of class n depends upon the goods they consume G , and the speed at which they work S . This is given by the function

$$U_n = G - S - \frac{3}{8} (S - n)^2, \quad n = 1, \dots, N.$$

Utility depends positively on the goods consumed and negatively on the speed of the assembly line. Higher grade workers are more willing to trade output for speed. The reason for the seemingly arbitrary fraction " $\frac{3}{8}$ " in the utility function results from a desire to have an equilibrium with all workers of the same class working at the same speed.

Output per worker on an assembly line depends upon its average grade of worker and also the speed at which it operates. The simplest such production function can be written

$$Q = \bar{\alpha} + S,$$

where Q is output per worker, $\bar{\alpha}$ is the average grade of worker on the assembly line, and S is the speed of the assembly line.

Capital is no constraint; and assembly lines can work at speeds S corresponding to any integer. The wage paid to each worker in equilibrium is equal to the output per worker on that assembly line.

To summarize, this is the complete specification of the economy. There are N classes of workers; there are assembly lines potentially operating at any integral speed. The solution to the economy consists of matching workers with assembly lines operating at different speeds. In equilibrium no worker will wish to move from the assembly line where he is working to an assembly line operating at a different speed.

Equilibrium. This model has the following equilibrium: Workers of type n , $n = 2, \dots, N$, will be working at speed $n + 1$; workers of type 1 will be working at speed 1. No worker will wish to move to an assembly line working at any other speed.

Proof. The proof is given in three parts. Part I shows that a worker of index n , $n \geq 3$ has no incentive to move from an assembly line of speed $n + 1$. Part II shows that a worker of index $n = 1$ has no incentive to move from an assembly line of speed 1. Part III shows that a worker of index $n = 2$ has no incentive to move from an assembly line of speed 3.

Part I

A worker of index $n, 3 \leq n \leq N - 1$ has no incentive to move. The northwest quadrant of Table I shows the utility of a type- n worker at equilibrium speed and if he moves to assembly lines one unit faster

TABLE I
UTILITY OF WORKER BY TYPE OF WORKER ON ASSEMBLY LINES AT EQUILIBRIUM AND ONE UNIT FASTER AND ONE UNIT SLOWER THAN EQUILIBRIUM

Type of worker	Speed	Average quality	Utility	Type of worker	Speed	Average quality	Utility
$3 \leq n \leq N - 1$	n	$n - 1$	$n - 1$	N	N	$N - 1$	$N - 1$
	$n + 1$	n	$n - 3/8$		$N + 1$	$N + 1$	$N - 3/8$
	$n + 2$	$n + 1$	$n - 1/2$		$N + 2$	N	$N - 3/2$
1	0	1	5/8	2	2	11/8	11/8
	1	1	1		3	2	13/8
	2	1	5/8		4	3	12/8

than the equilibrium ($n + 2$), and to speeds one unit slower than equilibrium (n). Speeds more than one unit faster or slower than equilibrium can easily be shown to be outside the range of consideration. The northwest quadrant of Table I shows that a worker of type n has highest utility at speed $n + 1$. Table I is derived by applying the formula

$$U_n = G - S - \frac{3}{8} (S - n)^2 = \bar{\alpha} - \frac{3}{8} (S - n)^2.$$

The northeast quadrant of Table I is analogous for workers of class N . Labor of index N receives maximum utility working at speed $N + 1$.

Part II

A worker of type 1 has no incentive to move from assembly lines of speed 1. The southwest quadrant of Table I shows the utility of type 1 if he moves to speeds 0 or 2 and if he remains at speed 1. Maximum utility is obtained at $S = 1$.

Part III

A worker of type 2 has no incentive to move. If he moves to speed 2, workers of type 1 will move onto these assembly lines until the utility of type 1 workers is the same on assembly lines of speeds 1 and

2. This will occur if the average quality on assembly lines of speed 2 is $11/8$. Thus, the southeast quadrant of Table I gives the utility that a worker of Type 2 will enjoy at equilibrium speed $S = 3$, and at speeds one unit faster and slower. His utility is maximized at speed $S = 3$.

Comment on Equilibrium

It is clear that in this solution everyone except type-1 workers is working at speeds faster than the optimum. In the absence of workers of other grades, each type of worker n would work at speed n , receiving utility in amount n . The solution is nonoptimal because each grade of worker (except for the lowest) works at a faster speed than in the absence of other workers—since each grade of worker wishes to avoid sharing its output with workers of lower grade. Workers increase their speed so as to winnow out poorer grades.

If the government places a tax on assembly lines of one unit per worker per unit speed, all workers will work at speed n . (This is easy to see by reconstruction of Table I with workers of type n working at speed n and a tax on work at speed n equal to n . For $n \leq N - 1$, workers of type n receive 0 utility at speed n . If they move to assembly lines one unit faster or one unit slower, they receive utility $-\frac{3}{8}$.) Since any redistribution of the taxes collected will leave the social rate of transformation of goods for speed equal to the marginal rate of substitution of goods for speed for each worker, such redistributions are Pareto optimal.

IV. STATISTICAL DISCRIMINATION

In the first two examples the *indicators* chosen have arisen for reasons of technology and production. They are used for natural economic reasons, given the utility functions, the production functions and the technology of obtaining information. In the next two examples the *indicators* chosen are based instead on social groupings whose existence is totally independent of utility functions, production functions, or information technology. The first two examples showed how *indicators* of natural origin caused distortions to marginal principles. The next two examples show how *indicators* of social origin may lead the economy into a low-level equilibrium trap.

We begin with Arrow's model¹² of *statistical discrimination*

12. Arrow, K. J., "Models of Job Discrimination," and "Some Mathematical Models of Race in the Labor Market," Chs. 2 and 6, in A. H. Pascal, ed., *Racial Discrimination in Economic Life* (Lexington: Heath, 1972). The model here is different in important detail from the original by Arrow, who does not consider the two equivalent. I am sure that he would agree that, however the mathematics differ, the economic spirit of the two models is the same.

(perhaps already familiar to the reader). In this example, under some circumstances, employers use the average quality of a given race to predict the quality of individuals of that race. It is easy to see that if such an *indicator* is used, it will destroy all incentive for self-improvement for that race, since all individuals of the race are judged the same and therefore paid the same wage irrespective of individual merit. In this way prejudice may produce a lower level equilibrium trap: if a race is deemed by prejudice to be unqualified, no incentive is given to become qualified, and the prophecy is self-fulfilling.

The Model

In this model there are just two types of jobs, one requiring qualified labor and the other requiring either qualified or unqualified labor. It is costly to test workers individually to see whether or not they are qualified. The change in proportion of qualified workers depends upon the incentives for self-improvement, which are differences in wages for qualified and unqualified workers of that race.

With slight modification of Arrow's notation and also of his equations, these assumptions lead to the following model. Let f_u be the marginal product of unqualified labor; f_q be the marginal product of qualified labor; let P_R be the proportion of race R predicted to be qualified. Let r be the cost spent per period to determine whether an individual worker is qualified. Let \dot{P}_R be the change in the proportion of qualified workers of race R . The newly qualified of race R depends upon the differential in wages paid to qualified and unqualified workers of that race. The rate of retirement of that race is λ , so we can write \dot{P}_R as

$$\dot{P}_R = \phi(w_{qR} - w_{uR}) - \lambda P_R,$$

where w_{qR} is the wage paid to qualified members of race R , and w_{uR} is the wage paid to unqualified members of race R .

If the expected costs of testing a worker of a given race exceed the difference in marginal products of qualified and unqualified workers, no worker will be tested, and all workers of that race will be used in unqualified jobs. Thus, competitive firms, earning zero profits, will pay wages

$$w_{qR} = \max(f_q - r/P_R, f_u)$$

$$w_{uR} = f_u,$$

and P_R becomes

$$\dot{P}_R = \phi(\max(f_q - r/P_R - f_u, 0)) - \lambda P_R.$$

If $\phi(0)$ is small (i.e., less than $\lambda r/(f_q - f_u)$), P_R has a locally stable low level equilibrium equal to $\phi(0)/\lambda$.

There are, however, some difficulties in applying this model to real-world racial discrimination. The costliness of testing workers' qualifications suggests that the traits necessary for qualification must also be difficult to observe.¹³ Arrow is specific in this regard: "I am thinking here not of the conventional type of education or experience, which is easily observable, but more subtle types the employer cannot observe directly: the habits of action and thought that favor good performance in skilled jobs, steadiness, punctuality, responsiveness, and initiative."¹⁴ Indeed, there is considerable evidence of the importance of these four qualities for job success.¹⁵ But is it also true, as implied by the equation for \dot{P}_R , that these "habits of thought and action" are acquired in response to wage differentials? Psychologists seem to believe that most fundamental personality traits are learned at an early age.¹⁶ If they are correct, the low-level trap will occur only if schooling and child-rearing techniques are responsive to wage incentives.

V. CASTE AND GROUP ORGANIZATIONS

Whether or not statistical discrimination in the fashion of Arrow is directly applicable to racial discrimination, his model is appealing in at least one respect. It differs fundamentally from the previous models of Becker¹⁷ and Welch,¹⁸ in which discrimination is explained by tastes. In these models any individual with positive taste for discrimination will receive positive economic rewards for reducing this taste. Thus in the Becker-Welch models discrimination persists *de-*

13. There is also the possibility that tests that are available for whites are not available for blacks. A recent Berkeley Ph.D. thesis reports that, although a group of blacks were more consistent in their answers to a long questionnaire than a group of whites, nevertheless, their IQ scores were significantly lower. See L. Dunn, "Labor Supply for Southern Industrialization," Ph.D. thesis, University of California, Berkeley, 1974, pp. 298 and 301.

14. Arrow, *op. cit.*, p. 97.

15. The essays in the book edited by Peter Doeringer, *Programs to Aid the Disadvantaged* (Englewood Cliffs, N.J.: Prentice-Hall, 1969), repeatedly and emphatically mention the importance of punctual and steady job attendance. E. Banfield in *The Unheavenly City* (Boston: Little, Brown and Company, p. 143) cites the findings of the Coleman Report that for blacks, *attitude* was the most important determinant for school success.

16. See Erik Erikson, *Childhood and Society* (New York: W. W. Norton, 1956, 1963).

17. Becker, G., *The Economics of Discrimination* (Chicago: University of Chicago Press, 1969).

18. Welch, F., "Labor-Market Discrimination: Extrapolation of Income Differences in the Rural South," *Journal of Political Economy*, LXXV (Aug. 1967), 584-96.

spite economic incentives. In contrast, in Arrow's example discrimination exists at least partially because of economic incentives.

It may appear that the tastes of persons in discriminating societies are so overwhelmingly biased in favor of discrimination that, relatively, the positive or negative effects of economic incentive are of only minor moment. But this ignores the broad historical perspective, which attempts to explain the stability (or disappearance) of institutions over a long period of time. For there are a fair number of cases where opportunities have arisen for deviants to break the caste code and make economic profits, with consequent rise in their social position and erosion of the caste taboos. Consider three diverse examples of this phenomenon. In Japan as merchants have become more economically successful, so too have the taboos against trade and manufacture been reduced.¹⁹ Even in caste-bound India caste status rises with the economic success of the caste, although, typically, newly successful castes also adjust their social customs, at least partially, to reflect their higher status.²⁰ The best example of economic success reducing taboos is, most probably, the elimination of the sanctions against collection of interest. The usurer of the Middle Ages has turned into the banker of today.

This section introduces a new class of models in which, as in Arrow's statistical-discrimination equilibrium trap, those who break caste customs suffer economically. This class of models depends upon an important facet of caste societies missing in previous models of discrimination. In previous models current transactions (so long as they are legal) do not result in changed relations with uninvolved parties in subsequent transactions.²¹ For example, if farmer *X* makes a contract for sale of wheat to speculator *Y*, his subsequent dealings with speculator *Z* will be unaffected. On the contrary, in a caste society any transaction that breaks the caste taboos changes the subsequent behavior of uninvolved parties toward the caste-breakers. To take an extreme example, consider what would happen if a Brahman should knowingly hire an outcaste cook: the Brahman would be outcasted,

19. See, for example, Marion Levy, "Contrasting Factors in the Modernization of China and Japan," in S. Kuznets *et al.*, eds., *Economic Growth: Brazil, India, Japan* (Durham, N.C: Duke University Press, 1955).

20. See M. N. Srinivas, *Social Change in Modern India* (Berkeley: University of California Press, 1967), pp. 7-8. For a detailed description of the upgrading of one caste and its links with economic opportunity, see Oscar Lewis, *Village Life in India* (New York: Vintage Books, 1965), pp. 70-77. It is clear that this caste would have found it much more difficult to upgrade its caste status in the absence of economic opportunities outside its village.

21. Note that one aspect of magic and taboo is that persons or events uninvolved in the Western sense, may be involved by *contagious* or *homeopathic* magic. See Sir James G. Frazer, *The Golden Bough* (New York: St. Martins, 1936).

and the cook would find subsequent employment almost impossible to obtain.

The possible intervention of third parties in a transaction allows for a richer class of *indicators* than that given by Arrow's statistical discrimination—typically, the use of *indicators* in caste societies being less narrowly technological. Generally, in a caste society if a member of caste A relates to a member of caste B in a given way, he can predict from knowledge of the relations between caste A and caste B how members of all castes will relate to him in future transactions. Such predictions can lead to an equilibrium in which all expectations are met and economic incentives favor obedience to the caste code—even in the extreme case where tastes are totally neutral regarding the observance of caste customs.

The following three conditions describe marriage customs in India.²²

1. Society is divided into mutually exclusive groups (called castes).

2. A code of behavior dictates how members of these castes should behave. Regarding marriage there are complicated rules as to who may marry whom, payment of the dowry, the timing and performance of the marriage rites, etc. The caste rules dictate not only the code of behavior, but also the punishment for infractions: violators will be outcasted; furthermore, those who fail to treat outcastes as dictated by caste code will themselves be outcasted.

3. Caste members predict that those who do not follow the caste code will be made outcastes and will receive the treatment of the average outcaste. An outcaste in India is permitted to hold only scavenging (or other polluting) jobs. He is not allowed to eat with caste members, to touch them, or to touch their food, which in the case of someone outcasted includes his own parents and siblings. Of course, his own children will be outcastes and will suffer the same prohibitions.

Why should these three conditions describing marriage customs in India be of interest to the economist? First, note that those who fail to follow, or even to enforce the caste customs do not gain the profits of the successful arbitrageur but instead suffer the stigma of the outcaste. If the punishment of becoming an outcaste is predicted to be sufficiently severe, the system of caste is held in equilibrium irrespective of individual tastes, by economic incentives; the predictions of the caste system become a self-fulfilling prophecy.²³

22. A good account of caste marriage customs is given in J. H. Hutton, *Caste in India* (Oxford University Press, Fourth Edition, 1961).

Second, the recent extensions of the model of supply and demand to discrimination, household organization, crime and marriage show that the boundaries between sociology and economics are by no means clear; if economic models can explain sociological phenomena, so also the process can work in reverse with sociological models describing economic phenomena. With appropriate adjustment, the model of marriage in India explains both economies pathologically different from the A-D utopia, and also special pathologies in economies in which perfect competition, or slight deviations therefrom, are the norm.

Finally, the formal model of caste equilibrium works spontaneously without direction of any individual or organization. But in this model it is also natural to have the exact same economic structure with some arbiter of the caste code. Indeed the model is therefore useful in indicating how individuals and organizations can yield great powers—quite possibly, as in some of the later examples, with considerable abuse.

Formal Model of Caste Equilibrium

This subsection presents a formal model of caste equilibrium. Caste equilibrium is defined as a state of the economy in which caste customs are obeyed, yet no single individual, by behaving differently, can make himself better off. The first concern is, of course, to describe this equilibrium. However, since there are also coalitions of individuals who by acting together can make themselves better off than in equilibrium, it is also of interest to know the relative ease or difficulty of forming such a coalition. For this purpose we also look at the size and nature of the smallest equilibrium-breaking coalition.

Four sets of assumptions describe the economy; those describing technology, market structures, tastes, and the social system. The assumptions describing the social system are laid out in parallel with the earlier description of marriage in India. In general this model is extremely simple, subject to one complication. By its very nature the caste system involves trade and the division of labor. If outcastes could set up their own economy independent of caste members, the caste system would fall apart. Therefore, three assumptions are inserted that lead individuals to trade with one another; laborers can produce only one product; firms produce only one product; and tastes are such that persons will wish to purchase more than one good.

23. Note that this is the “terrorist” model of economic activity. One good example is the terrorist regime of Henry V of England, described by G. Mattingly, *Catherine of Aragon* (New York: Random House Paperback, 1960). Note also that this model describes the college “honors” systems.

Technology T1. There are three types of jobs: skilled jobs, unskilled jobs, and scavenging jobs. (Subscripts sk , u , and sc refer to skilled, unskilled and scavenging, respectively.)

T2. There are n different products, labeled $i = 1, \dots, n$.

T3. The production of each product depends upon the quantity of labor employed and the jobs performed by the labor. Let θ_{sk} , θ_u , and θ_{sc} denote the output of one unit of labor in producing any product in a skilled job, unskilled job, or scavenging job, respectively. The production function of good i is then

$$q_i = \sum_j \theta_j n_{ij},$$

where

$$j = sk, u, sc, i = 1, \dots, n$$

q_i = output of product i , and

n_{ij} = quantity of labor employed in job type j in production of good i .

Of course,

$$(1) \quad \theta_{sc} < \theta_u < \theta_{sk}.$$

T4. Because of economies due to specialization workers can work on the production of only one product.

Market Structures. All firms are competitive profit maximizers. These firms can produce only one product. They hire labor and sell output on the market. A firm is willing to bid for labor the expected marginal value product of that labor.

Tastes. All persons have the same utility function U , which is independent of the caste code.

$$(2) \quad U = \sum_{i=1}^n \min(x_i, \alpha),$$

where x_i is consumption of good i and α is a parameter of the utility function.

Social Structure S1. By birth there are just two castes divided into a dominant caste D and a nondominant caste N . Labor of both castes D and N can be outcasted. Outcastes, if any, form a third group.

S2. The caste code dictates that D labor may work in only skilled jobs; N labor may work in only unskilled jobs; and outcaste labor may only hold scavenging jobs. The caste code also says that all persons who purchase from firms not using labor according to the caste code will themselves be outcasted.

S3. Persons predict that breakers of the caste code will be outcasted and receive the wages bid for outcaste labor.

Caste Equilibrium. Let the economy be described as above. Let w_k , $k = D, N$ denote the wage of caste k . Let p_i denote the price of good i produced by firms that use labor according to the caste code. Let good 1 be the numeraire good, with price equal to 1. Assume parameter values

$$(3) \quad \alpha < (\theta_u - \theta_{sc}) / (1 - \theta_{sc} / \theta_{sk})$$

and

$$(4) \quad n > \theta_{sk} / \alpha.$$

The following describe an equilibrium with fulfilled expectation:

1. $w_D = \theta_{sk}$, $w_N = \theta_u$.
2. The price of all goods produced by firms using labor according to caste code is 1.
3. There are no outcastes. N labor works at unskilled jobs. D labor works at skilled jobs.
4. Utility of D labor is θ_{sk} ; utility of N labor is θ_u .
5. The highest wage bid for outcaste labor is θ_{sc} .

A coalition of k^* firms, producing k^* different products and using outcaste labor in skilled jobs, can break this equilibrium if

$$k^* > (\theta_u - \theta_{sc}) / \alpha (1 - \theta_{sc} / \theta_{sk}).$$

Proof. It is obvious that the described equilibrium is feasible. We need show only that no new firm can make zero or positive profits and bid a higher wage either for N labor or for outcaste labor.

N Labor. Suppose that a new firm bids a higher wage for N labor than θ_u . It must use some of this labor in skilled jobs. In this case its profits per laborer will not exceed

$$p\theta_{sk} - \theta_u,$$

where p is the price received for its product. If profits are nonnegative,

$$p \geq \theta_u / \theta_{sk}.$$

But at a price as great as θ_u / θ_{sk} this firm will have no customers. Consider a prospective customer. This customer will be outcasted because N -labor is used in skilled jobs. Therefore, his expected wage is θ_{sc} . He will maximize expected utility by purchasing α units at a price p and $(\theta_{sc} - \alpha p)$ units of other goods from other firms that use labor according to the caste code.

His total utility will therefore be

$$(5) \quad \theta_{sc} - \alpha p + \alpha \leq \theta_{sc} - \alpha \theta_u / \theta_{sk} + \alpha.$$

But by (1) and (3) the right-hand side of (5) is less than θ_u .

Since the customer of this firm receives utility at least as large as θ_u if he does not purchase from the caste-breaking firm, the demand for the firm's products will be zero.

Outcaste Labor. No firm can bid a wage higher than θ_{sc} for outcaste labor and receive a profit if this bid is accepted. For a firm to pay a higher wage than θ_{sc} , it must employ outcaste labor in skilled or unskilled jobs. Its profits per laborer will not exceed

$$p \theta_{sk} - \theta_{sc}.$$

If profits are nonnegative,

$$p \geq \theta_{sc} / \theta_{sk}.$$

But at a price as great as $\theta_{sc} / \theta_{sk}$ the firm will have no customers: any prospective customer will be outcasted and expect to receive a wage θ_{sc} . Consider this customer. He will buy α units from this firm at a price p and will purchase $(\theta_{sc} - \alpha p)$ units of other goods from other firms. Therefore, his utility will be no greater than

$$(6) \quad \theta_{sc} - \alpha \theta_{sc} / \theta_{sk} + \alpha.$$

But since (6) is less than θ_u by (3), this firm will have no customers. Hence the maximum bid for outcaste labor will be θ_{sc} .

Equilibrium-Breaking Coalition

Finally, a coalition of k^* firms, $k^* > (\theta_u - \theta_{sc}) / \alpha (1 - \theta_{sc} / \theta_{sk})$ can break the equilibrium. Such firms can offer a wage bid θ_{sc} for outcaste labor, and offer to sell their output at a price $\theta_{sc} / \theta_{sk}$. The expected utility of a person purchasing from these firms will be

$$\min (\theta_{sk}, \theta_{sc} - k^* \alpha \theta_{sc} / \theta_{sk} + k^* \alpha),$$

which is greater than θ_u if $k^* > (\theta_u - \theta_{sc}) / \alpha (1 - \theta_{sc} / \theta_{sk})$. Thus the coalition of firms will be able to attract customers; and since workers will be better off receiving θ_{sc} in wages and purchasing from firms that break the caste code, these firms will also be able to attract workers.

Comments on Caste Equilibrium

1. The equilibrium described has two types of distortions due to caste structure. The equilibrium is not Pareto optimal, since in a

Pareto-optimal equilibrium N -workers would work in skilled jobs, for which they are fully qualified. Also, income distribution is skewed along caste lines, since in the absence of caste all workers would receive the same wage.

2. There is another equilibrium, also with fulfilled expectations, in which all workers work in skilled jobs and receive a wage θ_{sk} . The price of all goods is 1.

3. The smallest equilibrium-breaking coalition is the smallest group that can set themselves up as a separate subsector and be as well off as in equilibrium while trading with caste members on the terms of trade granted to outcastes.

In situations where this coalition must be large, where trade with the caste economy is necessary, or where the cost of forming a coalition is high, the threat to equilibrium of such a coalition is small. These principles are illustrated in the examples that follow.

Three Examples of Caste Equilibrium

Example 1. Racial Discrimination. Racial discrimination is implicit in the model, the major difference between the caste model and those of Becker, Welch, and Arrow²⁴ being in the assumption that persons use race to predict how everyone else will react to hiring persons of different races in different jobs. Their predictions result in a lower level equilibrium trap in which all predictions are met.²⁵

Example 2. Government-Business Groups. Allegedly many government-business groups, including the military-industrial state, governmental regulator-regulatee nexuses and political machines are held together by a caste-outcaste structure similar to that of our model. By nature the important operations of these groups are usually secret²⁶ or too technical for unambiguous assessment; but there are some recent and exceptional accounts of the detailed operation of particular political machines.²⁷

24. Arrow, *op. cit.*; Becker, *op. cit.*; Welch, *op. cit.*

25. Certainly our model gives a good first approximation to the apartheid system in South Africa. A. Lewis, "South Africa: The End Is Inevitable But Not Predictable," *New York Times Magazine*, September 21, 1975.

26. A recent incident epitomizes bureaucratic attitudes toward public disclosure. Alexander Butterfield, the bureaucrat whose own disclosure toppled the Nixon administration, wrote a memorandum to Haldeman regarding A. Ernest Fitzgerald, the government cost accountant who was fired after disclosing the Lockheed C-5A cost overruns. "Let him bleed a little," wrote Butterfield. According to the *New York Times Magazine*, Butterfield felt justified because "he considered Fitzgerald disloyal for not confining his reports to Air Force channels." A. R. Smith, "The Butterfield Exchange," *New York Times Magazine*, July 20, 1975.

27. See T. Harry Williams, *Huey Long* (New York: Knopf, 1969); R. A. Caro, *The Power Broker: Robert Moses and the Fall of New York City* (New York: Knopf, 1974); and paperback, (New York: Vintage, Random House, 1974).

The example of Robert Moses, the construction boss of New York City of long duration, illustrates especially well the applicability of the model. The story of Moses, as all such tales of powerful men, is in many ways unique—but his system of control through outcasting exactly corresponds to our model. There were a large variety of statuses in the Moses machine (from personal aide to Mayor of New York City); but it was clear to all concerned that disobedience to the boss's dictates regarding construction would lead to outcasting from the machine. For the politician, this meant loss of campaign funds and of the construction pork barrel and, consequently, the almost certain loss of his next election; for engineers it meant loss of job. Furthermore, it is reported, persons who failed to respect the outcaste status of those in Moses's disfavor were in turn threatened, becoming themselves the subjects of Moses's abuse and threats.²⁸ The uniqueness of Moses lay largely in his perfection of the system—mainly in his use of interlocking jobs to threaten the elected officials responsible for his reappointments and also in his use of the Triborough Bridge Authority (whose files, by a Moses-engineered legal quirk, were closed to public scrutiny) to maintain secret dossiers.

While the Moses example is extreme, it shows that in cases where public authority is delegated and cannot be easily scrutinized from outside, a caste-outcaste mechanism can arise that keeps the use of the authority secret while the resources are used for private aims. Because of the secrecy of such operations ipso facto, the importance of such misallocations for the distribution of income and of power is impossible to assess.

Example 3. Professional Groups. A final example (or set of examples) of the caste-class equilibrium occurs in professional groups. The public often delegates authority to professional organizations to police their own members—the most prominent of these being bar and medical associations. In turn, the members are expected to maintain professional conduct. Since cooperation with others in the profession is a necessary part of the job, the same outcasting mechanism used by caste, races, and government-business cliques enforces a professional unanimity that gives the profession more than its fair share of economic power.

28. See Caro's rather blunt description of Moses's style of operation: "Within a remarkably brief time after Moses entered the City Administration word spread through City Hall and the Municipal Building that any time anyone got in Moses's way Moses kicked him in the . . . So the men who worked in the two buildings were in general exceedingly careful not to get in his way, they went to great lengths to do exactly what he wanted—when he wanted."

VI. CONCLUSIONS

Our four woeful tales have described the ways in which the use of *indicators* can distort equilibrium. In so doing, we have also answered two challenges to economic theory.

The standard individualistic theories of income distribution and resource allocation are notable by the absence of variables describing social structure, except insofar as these variables affect exogenously given tastes or the initial allocation bundles. The absence of these variables poses the first challenge: to construct an individualistic theory in which income distribution and resource allocation reflect, to some extent, the divisions of society as described by the sociologists. The most common *indicators* are based upon the standard sub-cultural divisions of a society. And, as a result, the use of *indicators* makes equilibrium income distribution and resource allocation dependent on these divisions; and the first challenge is answered.

The second challenge to economic theory concerns the relation between marginalism and social custom. As long as most persons have positive utility for obeying social customs, and as long as activities are pursued up to the point where marginal costs equal marginal benefits, there will be rewards to breaking social customs insofar as they fail to promote economic efficiency. While such rewards occur sometimes, and they may also be spectacular, I would tend to believe that usually the greatest returns go to those who do not break social customs. Archetypically, they join the proper fraternity, work for the proper law firm, and may even marry the boss's daughter. In a segregationist society, such persons discriminate; in a caste society they follow the caste code. While not denying the possible returns to the arbitrageur and social deviant, the models of statistical discrimination and caste explain why economic rewards may favor those who follow prevailing social custom; and in so doing, they give economic reasons why such social customs may endure.

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