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The market for "lemons": quality uncertainty and the market mechanism

I. Introduction

This paper relates quality and uncertainty. The existence of goods of many grades poses interesting and important problems for the theory of markets. On the one hand, the interaction of quality differences and uncertainty may explain important institutions of the labor market. On the other hand, this paper presents a struggling attempt to give structure to the statement: "Business in underdeveloped countries is difficult"; in particular, a structure is given for determining the economic costs of dishonesty. Additional applications of the theory include comments on the structure of money markets, on the notion of "insurability," on the liquidity of durables, and on brand-name goods.

There are many markets in which buyers use some market statistic to judge the quality of prospective purchases. In this case there is incentive for sellers to market poor quality merchandise, since the returns for good quality accrue mainly to the entire group whose statistic is affected rather than to the individual seller. As a result there tends to be a reduction in the average quality of goods and also in the size of the market. It should also be perceived that in these markets social and private returns differ, and therefore, in some cases, governmental intervention may increase the welfare of all parties. Or private institutions may arise to take advantage of the potential increases in welfare which can accrue to all parties. By nature, however, these institutions are nonatomistic, and therefore concentrations of power – with ill consequences of their own – can develop.

The automobile market is used as a finger exercise to illustrate and

The author would especially like to thank Thomas Rothenberg for invaluable comments and inspiration. In addition he is indebted to Roy Radner, Albert Fishlow, Bernard Saffran, William D. Nordhaus, Giorgio La Malfa, Charles C. Holt, John Letiche, and the referee for help and suggestions. He would also like to thank the Indian Statistical Institute and the Ford Foundation for financial support.

develop these thoughts. It should be emphasized that this market is chosen for its concreteness and ease in understanding rather than for its importance or realism.

II. The model with automobiles as an example

A. The automobiles market

The example of used cars captures the essence of the problem. From time to time one hears either mention of or surprise at the large price difference between new cars and those which have just left the showroom. The usual lunch table justification for this phenomenon is the pure joy of owning a "new" car. We offer a different explanation. Suppose (for the sake of clarity rather than reality) that there are just four kinds of cars. There are new cars and used cars. There are good cars and bad cars (which in America are known as "lemons"). A new car may be a good car or a lemon, and of course the same is true of used cars.

The individuals in this market buy a new automobile without knowing whether the car they buy will be good or a lemon. But they do know that with probability q it is a good car and with probability $(1 - q)$ it is a lemon; by assumption, q is the proportion of good cars produced and $(1 - q)$ is the proportion of lemons.

After owning a specific car, however, for a length of time, the car owner can form a good idea of the quality of this machine; i.e., the owner assigns a new probability to the event that his car is a lemon. This estimate is more accurate than the original estimate. An asymmetry in available information has developed, for the sellers now have more knowledge about the quality of a car than the buyers. But good cars and bad cars must still sell at the same price – since it is impossible for a buyer to tell the difference between a good car and a bad car. It is apparent that a used car cannot have the same valuation as a new car – if it did have the same valuation, it would clearly be advantageous to trade a lemon at the price of a new car, and buy another new car, at a higher probability q of being good and a lower probability of being bad. Thus the owner of a good machine must be locked in. Not only is it true that he cannot receive the true value of his car, but he cannot even obtain the expected value of a new car.

Gresham's law has made a modified reappearance. For most cars traded will be the "lemons," and good cars may not be traded at all. The "bad" cars tend to drive out the good (in much the same way that bad money drives out the good). But the analogy with Gresham's law is not quite complete: bad cars drive out the good because they sell at the same price as good cars; similarly, bad money drives out good because the exchange rate is even. But the bad cars sell at the same price as good cars since it is impossible for a buyer to tell the difference between a good and a bad car; only the seller knows. In Gresham's law, however, presumably both buyer and seller can tell the difference between good and bad money. So the analogy is instructive, but not complete.

B. Asymmetrical information

It has been seen that the good cars may be driven out of the market by the lemons. But in a more continuous case with different grades of goods, even worse pathologies can exist. For it is quite possible to have the bad driving out the not-so-bad driving out the medium driving out the not-so-good driving out the good in such a sequence of events that no market exists at all.

One can assume that the demand for used automobiles depends most strongly upon two variables – the price of the automobile p and the average quality of used cars traded, μ, or $Q^d = D(p, \mu)$. Both the supply of used cars and also the average quality μ will depend upon the price, or $\mu = \mu(p)$ and $S = S(p)$. And in equilibrium the supply must equal the demand for the given average quality, or $S(p) = D(p, \mu(p))$. As the price falls, normally the quality will also fall. And it is quite possible that no goods will be traded at any price level.

Such an example can be derived from utility theory. Assume that there are just two groups of traders: groups one and two. Give group one a utility function

$$U_1 = M + \sum_{i=1}^{n} x_i$$

where M is the consumption of goods other than automobiles, x_i is the quality of the ith automobile, and n is the number of automobiles.

Similarly, let

$$U_2 = M + \sum_{i=1}^{n} \tfrac{3}{2} x_i$$

where M, x_i, and n are defined as before.

Three comments should be made about these utility functions: (1) Without linear utility (say with logarithmic utility) one gets needlessly mired in algebraic complication. (2) The use of linear utility allows a focus on the effects of asymmetry of information; with a concave utility function we would have to deal jointly with the usual risk-variance effects of uncertainty and the special effects we wish to discuss here. (3) U_1 and U_2 have the odd characteristic that the addition of a second car, or indeed a kth car, adds the same amount of utility as the first. Again realism is sacrificed to avoid a diversion from the proper focus.

To continue, it is assumed (1) that both type one traders and type two traders are von Neumann-Morgenstern maximizers of expected utility; (2) that group one has N cars with uniformly distributed quality x, $0 \leqq x \leqq 2$, and group two has no cars; (3) that the price of "other goods" M is unity.

Denote the income (including that derived from the sale of automobiles) of all type one traders as Y_1 and the income of all type two traders as Y_2. The demand for used cars will be the sum of the demands by both groups. When one ignores indivisibilities, the demand for automobiles by type one traders will be

$$\begin{aligned} D_1 &= Y_1/p \qquad && \mu/p > 1 \\ D_1 &= 0 && \mu/p < 1. \end{aligned}$$

And the supply of cars offered by type one traders is

$$(1) \quad S_1 = pN/2 \qquad p \leqq 2$$

with average quality

$$(2) \quad \mu = p/2.$$

(To derive (1) and (2), the uniform distribution of automobile quality is used.)

Similarly the demand of type two traders is

$$D_2 = Y_2/p \qquad 3\mu/2 > p$$
$$D_2 = 0 \qquad 3\mu/2 < p$$

and

$$S_2 = 0.$$

Thus total demand $D(p, \mu)$ is

$$D(p, \mu) = (Y_2 + Y_1)/p \qquad \text{if } p < \mu$$
$$D(p, \mu) = Y_2/p \qquad \text{if } \mu < p < 3\mu/2$$
$$D(p, \mu) = 0 \qquad \text{if } p > 3\mu/2.$$

However, with price p, average quality is $p/2$ and therefore at no price will any trade take place at all, in spite of the fact that *at any given price* between 0 and 3 there are traders of type one who are willing to sell their automobiles at a price which traders of type two are willing to pay.

C. Symmetric information

The foregoing is contrasted with the case of symmetric information. Suppose that the quality of all cars is uniformly distributed, $0 \leqq x \leqq 2$. Then the demand curves and supply curves can be written as follows:

Supply

$$S(p) = N \qquad p > 1$$
$$S(p) = 0 \qquad p < 1.$$

And the demand curves are

$$D(p) = (Y_2 + Y_1)/p \qquad p < 1$$
$$D(p) = (Y_2/p) \qquad 1 < p < \tfrac{3}{2}$$
$$D(p) = 0 \qquad p > \tfrac{3}{2}.$$

In equilibrium

$$(3) \qquad p = 1 \qquad \text{if } Y_2 < N$$
$$(4) \qquad p = Y_2/N \qquad \text{if } 2Y_2/3 < N < Y_2$$
$$(5) \qquad p = \tfrac{2}{3} \qquad \text{if } N < 2Y_2/3.$$

If $N < Y_2$ there is a gain in utility over the case of asymmetrical information of $N/2$. (If $N > Y_2$, in which case the income of type two traders is insufficient to buy all N automobiles, there is a gain in utility of $Y_2/2$ units.)

Finally, it should be mentioned that in this example, if traders of groups one and two have the same probabilistic estimates about the quality of individual automobiles – though these estimates may vary from automobile to automobile – (3), (4), and (5) will still describe equilibrium with one slight change: p will then represent the expected price of one quality unit.

III. Examples and applications

A. Insurance

It is a well-known fact that people over 65 have great difficulty in buying medical insurance. The natural question arises: why doesn't the price rise to match the risk?

Our answer is that as the price level rises the people who insure themselves will be those who are increasingly certain that they will need the insurance, for error in medical check-ups, doctors' sympathy with older patients, and so on make it much easier for the applicant to assess the risks involved than the insurance company. The result is that the average medical condition of insurance applicants deteriorates as the price level rises – with the result that no insurance sales may take place at any price.[1] This is strictly analogous to our automobiles case, where the average quality of used cars supplied fell

1 Arrow's fine article, "Uncertainty and Medical Care" (*American Economic Review,* Vol. 53, 1963), does not make this point explicitly. He emphasizes "moral hazard" rather than "adverse selection." In its strict sense, the presence of "moral hazard" is equally disadvantageous for both governmental and private programs; in its broader sense, which includes "adverse selection," "moral hazard" gives a decided advantage to government insurance programs.

with a corresponding fall in the price level. This agrees with the explanation in insurance textbooks:

> Generally speaking policies are not available at ages materially greater than sixty-five. . . . The term premiums are too high for any but the most pessimistic (which is to say the least healthy) insureds to find attractive. Thus there is a severe problem of adverse selection at these ages.[2]

The statistics do not contradict this conclusion. While demands for health insurance rise with age, a 1956 national sample survey of 2,809 families with 8,898 persons shows that hospital insurance coverage drops from 63 per cent of those aged 45 to 54, to 31 per cent for those over 65. And surprisingly, this survey also finds average medical expenses for males aged 55 to 64 of $88, while males over 65 pay an average of $77.[3] While noninsured expenditure rises from $66 to $80 in these age groups, insured expenditure declines from $105 to $70. The conclusion is tempting that insurance companies are particularly wary of giving medical insurance to older people.

The principle of "adverse selection" is potentially present in all lines of insurance. The following statement appears in an insurance textbook written at the Wharton School:

> There is potential adverse selection in the fact that healthy term insurance policy holders may decide to terminate their coverage when they become older and premiums mount. This action could leave an insurer with an undue proportion of below average risks and claims might be higher than anticipated. Adverse selection "appears (or at least is possible) whenever the individual or group insured has freedom to buy or not to buy, to choose the amount or plan of insurance, and to persist or to discontinue as a policy holder."[4]

Group insurance, which is the most common form of medical insurance in the United States, picks out the healthy, for generally

2 O. D. Dickerson, *Health Insurance* (Homewood, Ill.: Irwin, 1959), p. 333.

3 O. W. Anderson (with J. J. Feldman), *Family Medical Costs and Insurance* (New York: McGraw-Hill, 1956).

4 H. S. Denenberg, R. D. Eilers, G. W. Hoffman, C. A. Kline, J. J. Melone, and H. W. Snider, *Risk and Insurance* (Englewood Cliffs, N.J.: Prentice Hall, 1964), p. 446.

adequate health is a precondition for employment. At the same time this means that medical insurance is least available to those who need it most, for the insurance companies do their own "adverse selection."

This adds one major argument in favor of Medicare.[5] On a cost-benefit basis Medicare may pay off, for it is quite possible that every individual in the market would be willing to pay the expected cost of his Medicare and buy insurance, yet no insurance company can afford to sell him a policy – for at any price it will attract too many "lemons." The welfare economics of Medicare, in this view, is *exactly* analogous to the usual classroom argument for public expenditure on roads.

B. The employment of minorities

The Lemons Principle also casts light on the employment of minorities. Employers may refuse to hire members of minority groups for certain types of jobs. This decision may not reflect irrationality or prejudice – but profit maximization. For race may serve as a good *statistic* for the applicant's social background, quality of schooling, and general job capabilities.

Good quality schooling could serve as a substitute for this statistic; by grading students the schooling system can give a better indicator of quality than other more superficial characteristics. As T. W. Schultz writes, "The educational establishment *discovers* and cultivates potential talent. The capabilities of children and mature students can never be known until *found* and cultivated."[6] (Italics added.) An untrained worker may have valuable natural talents, but these talents must be certified by "the educational establishment"

5 The following quote, again taken from an insurance textbook, shows how far the medical insurance market is from perfect competition:

> "... insurance companies must screen their applicants. Naturally it is true that many people will voluntarily seek adequate insurance on their own initiative. But in such lines as accident and health insurance, companies are likely to give a second look to persons who voluntarily seek insurance without being approached by an agent." (F. J. Angell, *Insurance, Principles and Practices,* New York: The Ronald Press, 1957, pp. 8–9.)

This shows that insurance is *not* a commodity for sale on the open market.

6 T. W. Schultz, *The Economic Value of Education* (New York: Columbia University Press, 1964), p. 42.

before a company can afford to use them. The certifying establishment, however, must be credible; the unreliability of slum schools decreases the economic possibilities of their students.

This lack may be particularly disadvantageous to members of already disadvantaged minority groups. For an employer may make a rational decision not to hire any members of these groups in responsible positions – because it is difficult to distinguish those with good job qualifications from those with bad qualifications. This type of decision is clearly what George Stigler had in mind when he wrote, "in a regime of ignorance Enrico Fermi would have been a gardener, von Neumann a checkout clerk at a drugstore."[7]

As a result, however, the rewards for work in slum schools tend to accrue to the group as a whole – in raising its average quality – rather than to the individual. Only insofar as information in addition to race is used is there any incentive for training.

An additional worry is that the Office of Economic Opportunity is going to use cost-benefit analysis to evaluate its programs. For many benefits may be external. The benefit from training minority groups may arise as much from raising the average quality of the group as from raising the quality of the individual trainee; and, likewise, the returns may be distributed over the whole group rather than to the individual.

C. The costs of dishonesty

The Lemons model can be used to make some comments on the costs of dishonesty. Consider a market in which goods are sold honestly or dishonestly; quality may be represented, or it may be misrepresented. The purchaser's problem, of course, is to identify quality. The presence of people in the market who are willing to offer inferior goods tends to drive the market out of existence – as in the case of our automobile "lemons." It is this possibility that represents the major costs of dishonesty – for dishonest dealings tend to drive honest dealings out of the market. There may be potential buyers of good quality products and there may be potential sellers of such products in the appropriate price range; however, the presence of people who wish to pawn bad wares off as good wares tends to drive out the legitimate

7 G. J. Stigler, "Information and the Labor Market," *Journal of Political Economy,* Vol. 70 (Oct. 1962), Supplement, p. 104.

business. The cost of dishonesty, therefore, lies not only in the amount by which the purchaser is cheated; the cost also must include the loss incurred from driving legitimate business out of existence.

Dishonesty in business is a serious problem in underdeveloped countries. Our model gives a possible structure to this statement and delineates the nature of the "external" economies involved. In particular, in the model economy described, dishonesty, or the misrepresentation of the quality of automobiles, costs ½ unit of utility per automobile; furthermore, it reduces the size of the used car market from N to 0. We can, consequently, directly evaluate the costs of dishonesty – at least in theory.

There is considerable evidence that quality variation is greater in underdeveloped than in developed areas. For instance, the need for quality control of exports and State Trading Corporations can be taken as one indicator. In India, for example, under the Export Quality Control and Inspection Act of 1963, "about 85 per cent of Indian exports are covered under one or the other type of quality control."[8] Indian housewives must carefully glean the rice of the local bazaar to sort out stones of the same color and shape which have been intentionally added to the rice. Any comparison of the heterogeneity of quality in the street market and the canned qualities of the American supermarket suggests that quality variation is a greater problem in the East than in the West.

In one traditional pattern of development the merchants of the preindustrial generation turn into the first entrepreneurs of the next. The best-documented case is Japan,[9] but this also may have been the pattern for Britain and America.[10] In *our* picture the important skill of the merchant is identifying the quality of merchandise; those who can identify used cars in our example and can guarantee the quality may profit by as much as the difference between type two traders' buying price and type one traders' selling price. These people are the merchants. In production these skills are equally necessary – both to be able to identify the quality of inputs and to certify the quality of

8 *The Times of India,* Nov. 10, 1967, p. 1.

9 See M. J. Levy, Jr., "Contrasting Factors in the Modernization of China and Japan," in *Economic Growth: Brazil, India, Japan,* ed. S. Kuznets *et al.* (Durham, N.C.: Duke University Press, 1955).

10 C. P. Kindleberger, *Economic Development* (New York: McGraw-Hill, 1958), p. 86.

outputs. And this is one (added) reason why the merchants may logically become the first entrepreneurs.

The problem, of course, is that entrepreneurship may be a scarce resource; no development text leaves entrepreneurship unemphasized. Some treat it as central.[11] Given, then, that entrepreneurship is scarce, there are two ways in which product variations impede development. First, the pay-off to trade is great for would-be entrepreneurs, and hence they are diverted from production; second, the amount of entrepreneurial time per unit output is greater, the greater are the quality variations.

D. Credit markets in underdeveloped countries

(1) Credit markets in underdeveloped countries often strongly reflect the operation of the Lemons Principle. In India a major fraction of industrial enterprise is controlled by managing agencies (according to a recent survey, these "managing agencies" controlled 65.7 per cent of the net worth of public limited companies and 66 per cent of total assets).[12] Here is a historian's account of the function and genesis of the "managing agency system":

> The management of the South Asian commercial scene remained the function of merchant houses, and a type of organization peculiar to South Asia known as the Managing Agency. When a new venture was promoted (such as a manufacturing plant, a plantation, or a trading venture), the promoters would approach an established managing agency. The promoters might be Indian or British, and they might have technical or financial resources or merely a concession. In any case they would turn to the agency because of its reputation, which would encourage confidence in the venture and stimulate investment.[13]

In turn, a second major feature of the Indian industrial scene has been the dominance of these managing agencies by caste (or, more accurately, communal) groups. Thus firms can usually be classified

11 For example, see W. Arthur Lewis, *The Theory of Economic Growth* (Homewood, Ill.: Irwin, 1955), p. 196.

12 *Report of the Committee on the Distribution of Income and Levels of Living,* Part I, Government of India, Planning Commission, Feb. 1964, p. 44.

13 H. Tinker, *South Asia: A Short History* (New York: Praeger, 1966), p. 134.

according to communal origin.[14] In this environment, in which outside investors are likely to be bilked of their holdings, either (1) firms establish a reputation for "honest" dealing, which confers upon them a monopoly rent insofar as their services are limited in supply, or (2) the sources of finance are limited to local communal groups which can use communal – and possibly familial – ties to encourage honest dealing *within* the community. It is, in Indian economic history, extraordinarily difficult to discern whether the savings of rich landlords failed to be invested in the industrial sector (1) because of a fear to invest in ventures controlled by other communities, (2) because of inflated propensities to consume, or (3) because of low rates of return.[15] At the very least, however, it is clear that the British-owned managing agencies tended to have an equity holding whose commu-

14 The existence of the following table (and also the small per cent of firms under mixed control) indicates the communalization of the control of firms. *Source:* M. M. Mehta, *Structure of Indian Industries* (Bombay: Popular Book Depot, 1955), p. 314.

Distribution of industrial control by community

	Number of firms		
	1911	1931	1951
British	281	416	382
Parsis	15	25	19
Gujratis	3	11	17
Jews	5	9	3
Muslims	—	10	3
Bengalis	8	5	20
Marwaris	—	6	96
Mixed control	28	28	79
Total	340	510	619

Also, for the cotton industry see H. Fukuzawa, "Cotton Mill Industry," in V. B. Singh, editor, *Economic History of India, 1857–1956* (Bombay: Allied Publishers, 1965).

15 For the mixed record of industrial profits, see D. H. Buchanan, *The Development of Capitalist Enterprise in India* (New York: Kelley, 1966, reprinted).

nal origin was more heterogeneous than the Indian-controlled agency houses, and would usually include both Indian and British investors.

(2) A second example of the workings of the Lemons Principle concerns the extortionate rates which the local moneylender charges his clients. In India these high rates of interest have been the leading factor in landlessness; the so-called "Cooperative Movement" was meant to counteract this growing landlessness by setting up banks to compete with the local moneylenders.[16] While the large banks in the central cities have prime interest rates of 6, 8, and 10 per cent, the

16 The leading authority on this is Sir Malcolm Darling. See his *Punjabi Peasant in Prosperity and Debt.* The following table may also prove instructive:

	Commonest rates for		
	Secured loans (per cent)	Unsecured loans (per cent)	Grain loans (per cent)
Punjab	6 to 12	12 to 24 (18¾ commonest)	25
United Provinces	9 to 12	24 to 37½	25 (50 in Oudh)
Bihar		18¾	50
Orissa	12 to 18¾	25	25
Bengal	8 to 12	9 to 18 for "respectable clients"	—
		18¾ to 37½ (the latter common to agriculturalists)	—
Central Provinces	6 to 12	15 for proprietors	25
		24 for occupancy tenants	—
		37½ for ryots with no right of transfer	—
Bombay	9 to 12	12 to 25 (18 commonest)	—
Sind		36	—
Madras	12	15 to 18 (in insecure tracts 24 not uncommon)	20 to 50

Source: Punjabi Peasant in Prosperity and Debt, 3rd ed. (Oxford University Press, 1932), p. 190.

local moneylender charges 15, 25, and even 50 per cent. The answer to this seeming paradox is that credit is granted only where the granter has (1) easy means of enforcing his contract or (2) personal knowledge of the character of the borrower. The middleman who tries to arbitrage between the rates of the moneylender and the central bank is apt to attract all the "lemons" and thereby make a loss.

This interpretation can be seen in Sir Malcolm Darling's interpretation of the village moneylender's power:

> It is only fair to remember that in the Indian village the moneylender is often the one thrifty person amongst a generally thriftless people; and that his methods of business, though demoralizing under modern conditions, suit the happy-go-lucky ways of the peasant. He is always accessible, even at night; dispenses with troublesome formalities, asks no inconvenient questions, advances promptly, and if interest is paid, does not press for repayment of principal. He keeps in close personal touch with his clients, and in many villages shares their occasions of weal or woe. *With his intimate knowledge of those around him he is able, without serious risk, to finance those who would otherwise get no loan at all.* [Italics added.][17]

Or look at Barbara Ward's account:

> A small shopkeeper in a Hong Kong fishing village told me: "I give credit to anyone who anchors regularly in our bay; but if it is someone I don't know well, then I think twice about it unless I can find out all about him."[18]

Or, a profitable sideline of cotton ginning in Iran is the loaning of money for the next season, since the ginning companies often have a line of credit from Teheran banks at the market rate of interest. But

17 M. Darling, *Punjabi Peasant,* p. 204.

18 B. Ward, "Cash or Credit Crops," *Economic Development and Cultural Change,* Vol. 8 (Jan. 1960), reprinted in *Peasant Society: A Reader,* ed. G. Foster *et al.* (Boston: Little, Brown and Company, 1967), quote on p. 142. In the same volume, see also G. W. Skinner, "Marketing and Social Structure in Rural China," and S. W. Mintz, "Pratik: Haitian Personal Economic Relations."

in the first years of operation large losses are expected from unpaid debts – due to poor knowledge of the local scene.[19]

IV. Counteracting institutions

Numerous institutions arise to counteract the effects of quality uncertainty. One obvious institution is guarantees. Most consumer durables carry guarantees to ensure the buyer of some normal expected quality. One natural result of our model is that the risk is borne by the seller rather than by the buyer.

A second example of an institution which counteracts the effects of quality uncertainty is the brand-name good. Brand names not only indicate quality but also give the consumer a means of retaliation if the quality does not meet expectations. For the consumer will then curtail future purchases. Often too, new products are associated with old brand names. This ensures the prospective consumer of the quality of the product.

Chains – such as hotel chains or restaurant chains – are similar to brand names. One observation consistent with our approach is the chain restaurant. These restaurants, at least in the United States, most often appear on interurban highways. The customers are seldom local. The reason is that these well-known chains offer a better hamburger than the *average* local restaurant; at the same time, the local customer, who knows his area, can usually choose a place he prefers.

Licensing practices also reduce quality uncertainty. For instance, there is the licensing of doctors, lawyers, and barbers. Most skilled labor carries some certification indicating the attainment of certain levels of proficiency. The high school diploma, the baccalaureate degree, the Ph.D., even the Nobel Prize, to some degree, serve this function of certification. And education and labor markets themselves have their own "brand names."

V. Conclusion

We have been discussing economic models in which "trust" is important. Informal unwritten guarantees are preconditions for trade and

19 Personal conversation with mill manager, April 1968.

production. Where these guarantees are indefinite, business will suffer – as indicated by our generalized Gresham's law. This aspect of uncertainty has been explored by game theorists, as in the Prisoner's Dilemma, but usually it has not been incorporated in the more traditional Arrow-Debreu approach to uncertainty.[20] But the difficulty of distinguishing good quality from bad is inherent in the business world; this may indeed explain many economic institutions and may in fact be one of the more important aspects of uncertainty.

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20 R. Radner, "Équilibre de Marchés à Terme et au Comptant en Cas d'Incertitude," in *Cahiers d'Econometrie,* Vol. 12 (Nov. 1967), Centre National de la Recherche Scientifique, Paris.