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PROMISE KEEPING IN THE GREAT SOCIETY: A MODEL OF CREDIT INFORMATION SHARING

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Reputation is possible in a small community, but in the Smith–Lippmann–Hayekian Great Society people are mainly strangers. I model credit reporting as a system of formalized and surgically-precise gossip. In the Great Society credit reporting makes possible reputations, which make possible credit relationships. But forming a credit reporting system is no simple matter. Historically it has been local gossip in the small community that has made possible credit reporting "gossip" in the Great Society.

1. INTRODUCTION

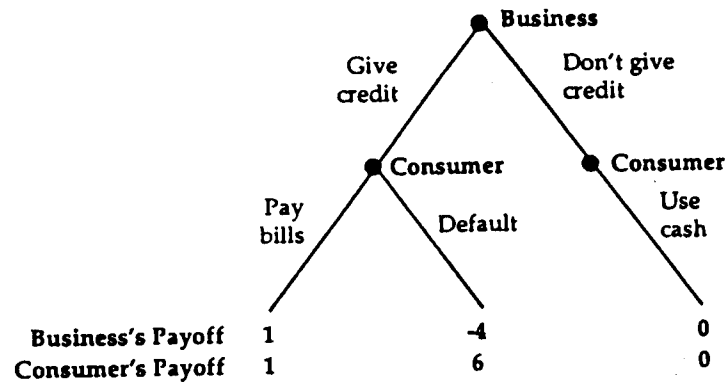
ADAM SMITH said the following in 1763 in a lecture entitled, "The Influence of Commerce on Manners:"

> Of all the nations in Europe, the Dutch, *the most commercial*, are the most faithful to their word. The English are more so than the Scotch, but much inferior to the Dutch. . . . This is not at all to be imputed to national character, as some pretend; there is no natural reason why an Englishman or a Scotchman should not be as punctual in performing agreements as a Dutchman. It is far more reducible to self-interest, . . . [which] is as deeply implanted in an Englishman as a Dutchman. A dealer is afraid of losing his character, and is scrupulous in observing every engagement. When a person makes perhaps twenty contracts a day, he cannot gain so much by endeavoring to impose on his neighbours, as the very appearance of a cheat would make him lose. When people seldom deal with one another, we find that they are somewhat disposed to cheat, because they can gain more by a smart trick than they can lose by the injury which it does their character (Smith, 1964, italics added, pp. 253–54).

By keeping tabs on each of us in our role as consumer a credit bureau helps to turn us into Dutchmen. Unpaid bills endanger one's credit rating, so many of us refrain from any "smart tricks." The historical dependence of credit activity on credit reporting suggests that this is a big reason for paying up (Cole, pp. 184–85).

In this paper I build a model of consumer credit information sharing. Consumers and businesses are matched randomly each period to play a game like that shown in Figure 1. If the business gives credit and the consumer pays her bill, both parties benefit. The business benefits because "[c]redit customers appear to form a habit at stores where they have credit privileges" (Cole, p. 153), and the consumer benefits from the greater convenience and security of using credit.

In a one-shot encounter, however, credit may confer an even bigger benefit to the consumer: she can get the goods for free. Why not just disregard the tailor's



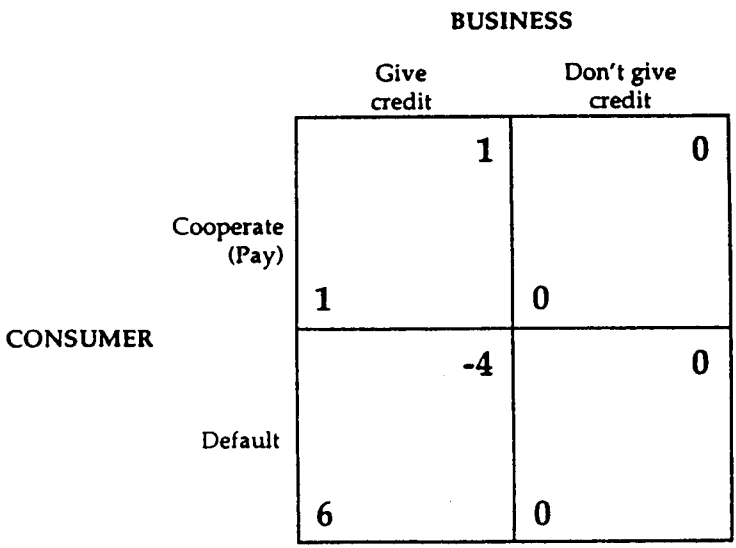


Figure 1.

bill for $200 or the dentist's bill for $400? Foreseeing default the business does not give credit. The equilibrium payoff is zero for each player. If the game were repeated infinitely with the same players cooperation could arise, but we are interested in the roaming consumer. In this case businesses need to act as a group in keeping tabs on consumers and meting out punishment.

The second part of the model investigates the business's decision of whether to join the bureau. The subscription decision of one business affects the payoff

of other businesses in several ways: information on consumers is enhanced, average bureau cost may be reduced, and consumer behavior is improved. In both the credit stage game and the overarching subscription game we find socially inefficient equilibria. In a later section I discuss ways in which nonmarket institutions have addressed the problem of establishing a bureau.

Before developing the model[1] I discuss the credit bureau as a sort of institutionalized system of gossip in a "Great Society," and credit bureaus as they actually exist in the U.S.

2. SOCIAL CONTROL IN THE SMALL COMMUNITY AND THE GREAT SOCIETY

Research on repeated games shows how cooperation can prevail without a policeman wielding a night-stick over deviant behavior. The thought has given a freshness to research on informal means of social control. Many books use repeated games to get at what holds society together and the proper role of the state [Schotter (1981), Axelrod (1984), Sugden (1986), Ullman-Margalit (1977), Hechter (1987), Taylor (1976), Frank (1988)].

From this literature we draw some hope that society can be self-policing. But what kind of society? The society of repeated game thinking in its many variations is a *tight set* of players interacting period after period [e.g., Fudenberg & Maskin (1986), Cremer (1986), Radner (1980), Friedman (1985), Samuelson (1987), Kreps *et al.* (1982)]. In the evolutionary models the population is expansive and interaction is varying, but the results rest on the much less pleasing assumption of hard-wired behavior. Even in small communities the formal assumptions of repeated games are not met.

Yet work in numerous disciplines supports the idea that cooperation can be sustained in the small community. There are two reasons why self-policing can be sustained despite the roughness of the fit to our models: First, because norms are internalized, people develop a taste for cooperating (this is Jon Elster's "cement of society" (1989), which I leave aside in this paper). Second, even though real community interaction is haphazard, information about member performance travels through the community. People gossip.

Gossip scholarship speaks of this function [Gluckman (1963), Paine (1970), Merry (1984), Hechter (1987, pp. 155–56)]. The term "gossip" is used as a synecdoche for community information transmission achieved through group meetings, correspondence, local newspapers, leaflets, word of mouth, and so on. Consider the following series of remarks taken from Merry (1984):

"[G]ossip can be viewed as a means of storing and retrieving information . . ." (p. 275).

[1] In the dissertation version of the paper (Klein, 1989) I also work out: (a) strong equilibria for nontransferable and transferable utility, (b) optimal government policy (subsidization or taxation of bureau membership); (c) steady-state equilibria with a finite bureau contract; and (d) a numerical example.

"[T]he individual seeks to manage and control the information spread about him or her through gossip" (p. 275).

"Gossip is about reputation, particularly lapses between claims to reputation and reports of actual behavior" (p. 277).

"Gossip creates cognitive maps of social identities and reputations. It forms dossiers on each member of one's community: who is a good curer, who can be approached for loans, who is powerful, who is a witch, who is a good worker, and who is a thief" (p. 279).

"[Gossip produces] the implementation of the consensus, the transformation of shared opinions into some form of action. This action can range from individual acts of snubbing to collective decisions to expel" (p. 279).

In the search for self-policing society it is useful to demark three kinds of settings.[2] First, tight-set repeated interaction like traditional game thinking. Macauley's (1963, p. 63) well-known discussion of self-policing business relationships is a good example: "Salesmen often know purchasing agents well. The same two individuals occupying these roles may have dealt with each other from five to 25 years." Other examples of tight-set repeated interaction would include relationships between immediate neighbors, family members, fellow employees, or landlord and tenant.

A second setting is the small community where interaction is more haphazard but informal information flow (gossip) ensures the diffusion of information about performance. Various historical and anthropological studies record the effectiveness of informal means of social control (e.g., Landa (1981), Klein (1990)). Also, recent theoretical breakthroughs demonstrate the feasibility of cooperation in games where opponents vary but information is spread through the community [Kandori (1989), Okuno-Fujiwara & Postlewaite (1988). Bernhardt (1989), Harrington (1989), and, less formally, Tullock (1985)]. The title of Kandori's theoretical work is apt for this discussion: "Social Norms and Community Enforcement."

Third, there is the Great Society. I use the term not in the sense of President Johnson (namely assistance to the less advantaged), but in the sense of Adam Smith,[3] Walter Lippmann (1937), and Friedrich Hayek (1973, 1976, 1979). A Great Society is a society of vast division of labor, of individual objectives among its members, of dispersed knowledge, of undesigned intermeshing of activities, of a high degree of anonymity. In the Great Society man stands, as Adam Smith put it, "at all times in need of the cooperation and assistance of great multitudes, while his whole life is scarce sufficient to gain the friendship of a few persons" (1937, p. 14).

[2] I hope the reader will forgive my variation in terminology. An anthropologist or sociologist will use the term "social control." A game theorist will speak of "cooperation." For my larger point I find "self-policing" particularly useful, especially when coupled with "society." "Promise keeping" is apt for the particular example of credit. These terms are not perfectly interchangeable. For a discussion of social control ideas see Ellickson (1987).

[3] Hayek (1973, p. 148) gives a brief history of the term "Great Society."

Pockets within a Great Society may form a community unto itself and enjoy social control of the second type described (the gossip setting), but across all members of a Great Society gossip is impossible. Thus Merry says, "with increasing social complexity, informal social controls diminish in significance and are replaced by formal mechanisms of social control" (p. 288). In Lippmann's statement of the Great Society, he said, "the state exerts social control chiefly through the judicial hearing of individual complaints and the provision of individual remedies" (p. 289). The vastness and anonymity of the Great Society calls for the existence of formal agencies geared toward policing good behavior. The Great Society coheres by virtue of the policeman's night-stick.

The case of credit bureaus show that this is not the whole story. Despite the multitudinous population and the vast geography of a Great Society, the social role of gossip can be emulated by institutions geared toward information storage and transmission. Like the Law Merchant of centuries past [Milgrom, North, and Weingast (1990), Benson (1989)] or other information systems used by merchants [Greif (1989)], the credit bureau gives us hope that the trade-off between Great Society existence and self-policing may not be as large as we think.[4]

The credit bureau is a leading Great Society institution of this nature. It is certainly the most standardized and most extensive reputational system humankind has ever known. In addition to consumer credit reporting there is commercial credit reporting, a field dominated by Dun & Bradstreet. Other modern institutions, like the Better Business Bureau or *Consumer Reports*, play a similar role for business reputation (Klein & Leffler (1981)). The credit bureau and the Law Merchant can be thought of as Great Society applications of Kandori (1989) and Okuno-Fujiwara & Postlewaite (1988). This paper is in spirit very similar to Milgrom, North, and Weingast (1990), although there are numerous differences in the set-up and the results.[5]

3. CREDIT BUREAUS IN AMERICA

The Fair Credit Reporting Act (1971), which regulates the activities of all consumer reporting agencies, defines them in Section 603(f) as:

> any person which, for monetary fees, dues, or on a cooperative nonprofit basis, regularly engages in whole or in part in the practice of assembling or evaluating consumer credit

[4] Benson (1990) and Ellickson (1991) reinforce hope in the feasibility of customary law.

[5] A basic difference between the assumptions of this paper and those of Milgrom, North, & Weingast (1990) is that in this paper the stage game is a one-sided prisoner's dilemma—the business cannot cheat the consumer. Hence only one side of the interactions, the businesses, needs to share information. In the MN&W paper there are several other assumptions that differ from mine: traders would be punished for not checking on and punishing cheaters, those cheated can win a judgement, players are homogeneous, and a trader's access to the Law Merchant is common knowledge.

In results, one qualitative difference between MN&W and this paper, arising from the difference in informational assumptions, is that I can get a mixed equilibrium where some businesses subscribe to the bureau and some do not. Another qualitative difference, arising from heterogeneous consumers, is that in this paper some consumers pay their bills and others default.

information or other information on consumers for the purpose of furnishing consumer reports to third parties . . .

The "third parties" referred to are customarily either retail businesses which extend credit privileges, employers, or insurance companies. In this paper I discuss the usage of consumer reports by retail businesses only.

Most credit-granting retail businesses provide information on their customers to one or more credit bureaus. "The contract credit grantors sign to become bureau subscribers specifies that they provide their ledger experience promptly and accurately" (Cole, p. 190).

There are two types of firms that contribute data from their accounts receivable ledgers: (1) businesses which subscribe to a bureau in the same geographic area and use the bureau to obtain consumer credit reports, and (2) national firms, such as Sears, Texaco, and VISA, which may or may not ever use a particular credit bureau, yet buy large numbers of reports from many bureaus.

Many regional and national credit-granting businesses provide their accounts receivable data to the three commercial repositories of the industry.[6] These repositories are the giants of the industry and have roughly the same information. As a group the giants own about 150 offices in the major U.S. cities. In addition, about 400 computerized independent bureaus contract for access to one or more of the giants. Through both types of bureaus the giants provide the vast majority of the credit information.

TRW, one of the giants, publicizes the fact that it maintains credit information on more than 133 million consumers, and that more than 8,000 businesses regularly contribute their accounts receivable data to TRW. Another, Trans Union, says it maintains 170 million credit files, covering approximately 80% of all U.S. households (Cole, p. 202).

The term "subscriber" in this paper relates to the local firm which has membership in, and pays dues to, a specific credit bureau. The credit bureau may be an owned office of a repository, a contracted bureau obtaining information from a repository, or a manual bureau. Most bureaus charge a monthly sign-up fee and then a unit price for reports. "Each bureau establishes its own price" (Cole, p. 196). For a nonsubscribing business, acquiring credit reports is much more expensive—such as fivefold the price to subscribers—and is more difficult, often involving delays.

Most credit-granting businesses rely heavily on credit reports, and most consumers wisely show concern for their credit record. One of the first threats made to a delinquent is to report the matter to a bureau (Cole, p. 246).[7]

[6] The three commercial giants are TRW Information Services, Trans Union Credit Information, and Credit Bureau Inc./Equifax. There is a fourth repository, Associated Credit Bureaus, created in the 1970's to enable noncomputerized credit bureaus to survive. It is operated by the nonprofit trade association of the industry and generates monthly printouts which are sold to noncomputerized credit bureaus, giving them access to similar information the computerized bureaus have.

[7] For an interesting discussion of how some credit markets are divided to save information costs, see Staten, Gilley & Umbeck (1990).

Some businesses, most notably small town businesses or businesses in the health field, extend credit but do not belong to a credit bureau. A business might not subscribe to a bureau because its customers do not know whether it does. Thus the business can wield the threat of credit-record damage without paying the price to the bureau. There is no way for businesses to demonstrate subscribership to consumers.[8]

The consumer of course may have reasons other than the preservation of her credit record for paying her bills: continuing relations with the business, the fear of legal recourse by the business or a designated collection agency, or just a sense of good conduct. The defaulting customer could, however, just begin using cash or a bank card at the business. And as for legal action, one collection agency I spoke with said that no measures beyond nasty letters are taken for receivables below $225. Thus, for purchases below a certain amount, none of these reasons need impede fraud by the conscience-free consumer.

Thus the following stylized fact about our current institutions can be used to form a model of credit bureaus:

1. There is a two-way flow of information between subscribers and a credit bureau. The subscribers provide information about their customers' credit performance, and the bureau provides reports on credit applicants.
2. Bureaus charge a sign-up fee and a unit price per report. It is much more expensive and much more troublesome for an unaffiliated business to order a consumer credit report. (In the model I assume that the bureau charges just a subscription (or sign-up) fee and provides one credit report each period, and that nonsubscribers cannot acquire reports.)
3. There is essentially one central source of information about consumers' credit histories.
4. Consumers do not know if a business is a subscriber.
5. When alternative means of purchase are available (notably cash), there is no economic incentive for a consumer to pay bills below the threshold for legal action, other than the preservation of her credit record.
6. There are credit-granting businesses that choose not to participate in the credit information network.

4. THE MODEL

4.1 The Players

Businesses. All businesses are identical and infinitely lived. The set of businesses is J, a continuum on [0,1].

[8] Associated Credit Bureaus makes up plastic plaques indicating bureau membership, but very few are purchased or displayed. People in the industry have suggested to me that businesses are hesitant to greet customers with such a sign at their counter because consumers—who are generally ignorant and suspicious of credit bureaus—may take it badly. Dunkelberg *et al.* (undated) show that both good consumers and defaulters are uncertain and apprehensive about credit bureaus.

Consumers. At period $t=0$ there is a set I of consumers. The probability that any consumer alive in period t will be alive in period $t+1$ is q. The passing consumers are replaced by new consumers, each period comprising $(1-q)$ of the consumer population. Each consumer has for her entire life type A_i, which is explained economically in the next subsection. A_i is distributed according to density function $g(A)$, which has strictly positive support on the interval $[\underline{A}, \bar{A}]$.

4.2 Stage Game

The stage game at each period beginning with $t=1$ is shown in Figure 2. It is repeated infinitely with freshly matched pairs. The stage-game strategy space is binary for both classes of players: the business decides whether to give credit, then the consumer decides whether to pay her bill. Mixed strategies are permitted. The consumer's type, A_i, is private information and corresponds to her stage-game payoff from {Give credit, Default}. The heterogeneity of consumers' default payoffs represents the different propensities of consumers to default, whether it is because of variations in financial solvency or in personal character. All other stage-game payoffs are constant across players, with $0<b, B$. As for the distribution of A_i, we permit some portion of them to be less than a (which is possible), corresponding to those members of the population that honestly pay their bills without any external material incentive, just like those of us who leave tips in roadside restaurants. However, we assume that the portion of such purists is not high enough to induce a business to give credit to a random and totally unknown customer. Thus, in the absence of a credit bureau no credit is used in the economy.

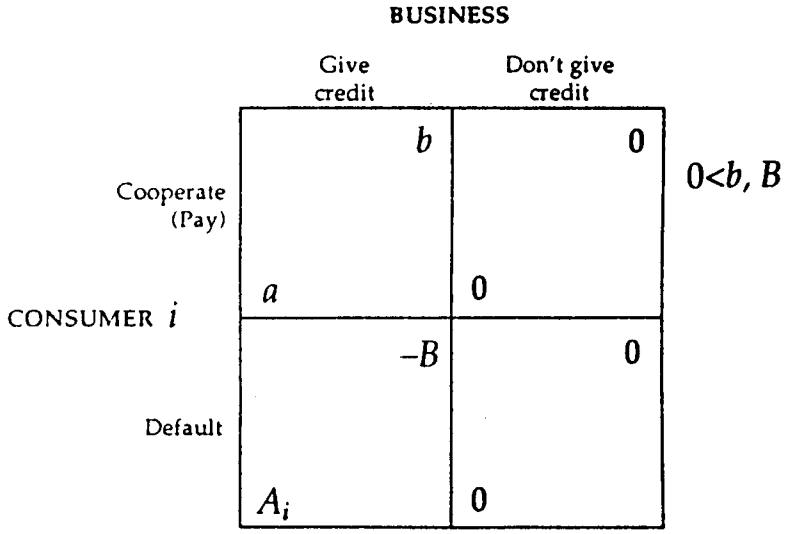


Figure 2.

I assume that the probability of a currently matched pair being matched agai is zero, and that there is a discount factor $\delta \in (0,1)$ common to all players. Al of the foregoing is common knowledge.

4.3 *The Credit Bureau*

At the start of the supergame each business j chooses whether to join the credi bureau, $\{Y,N\}$. If j chooses (Y), it is committed to the following protocol fo the remainder of the game:

1. If j gave credit to consumer i in period t, j immediately notifies the credi bureau of whether i paid her bill. The information on i accumulated in thi manner is consumer i's *credit record.*
2. At the start of period t, j consults the credit record of his current credit applicant i. If the credit record shows that i is a *defaulter*, j does not give credit. (Con sumer i is a defaulter if her credit record contains a default; otherwise is a *nondefaulter.*) If i is a nondefaulter, j decides for himself whether t give credit.
3. In each period t, j pays the bureau his *per period subscription fee* $f(:)$ (Although these bureau payments are made each period, the paymen schedule is set in place at $t=0$.)

The subscription fee is a continuous and differentiable function of th proportion of businesses that subscribe, which is denoted X. (X will also b referred to as "bureau size.") I make the natural assumptions that for an $X \in [0,1]$, $f(:)$ is nonincreasing and everywhere positive, and the total fees o all businesses is increasing in X. Businesses that choose (N) have no access t consumer credit reports and remain isolated players. [Klein (1989) considers finit bureau subscription and solves for the steady-state equilibrium where businesse choose whether to renew subscription.]

After the subscription decisions are made, consumers are informed immediatel of the value of X. They do not know, however, which businesses have joine the bureau, and they place a probability of X on any given business having joined

Except for two behavioral assumptions provided in the next section, the gam is specified. We will consider the conditions that give rise to equilibria. We wil also see that the bureau protocol would be a subgame perfect equilibriun if subscribers had free choice in abiding by it, so the protocol is in fac self-enforcing.

4.4 *Simplifying Preliminary Result*

By the homogeneity and zero measure of businesses we know that thei equilibrium payoffs must be equal. If they were unequal the less-well-off busines

would not be playing a best response. We now impose two behavioral assumptions which simplify the analysis.

Behavioral Assumptions on Consumers: (A) Each consumer behaves as though every subscriber were giving credit to every nondefaulter and every nonsubscriber were giving credit to every consumer. (This behavior on the part of businesses is abbreviated by the phrase, *businesses are giving credit.*) (B) Consumers do not make their strategies business specific.

Behavioral Assumption on Businesses: Given some aggregate consumer behavior, if the expected single-period return to giving credit is zero, the business gives credit.

These assumptions rule out "small", awkward and implausible classes of equilibria. Behavioral assumption (A) on consumers is self-justifying in equilibrium whenever the expected single-period payoff to giving credit is positive, and when the payoff is zero the assumption on business behavior makes it self-justifying. Behavioral assumption (B) on consumers rules out awkward equilibria in which every consumer defects at a particular business and that business does not join the bureau and does not give credit. The assumption on business behavior is harmless because we are simply imposing one of a set of equally good choices at a single point in a continuum.

We can now establish the preliminary result that guides our investigation:

Proposition: *For any Nash equilibrium* s^*, *either*

(1) $X^* = 0$ *and no business gives credit;*

or (2) $X^* > 0$, *all businesses give credit and receive a common discounted sum of stage payoffs.*

Proof: When $X^* = 0$, consumers would never pay their bills so every business would not give credit.

When $X^* > 0$, every subscriber must be giving credit with positive probability to nondefaulters, since otherwise there is no sense in paying the bureau fee, and if it is profitable to give credit with positive probability it is most profitable to always give credit to a nondefaulter. Every nonsubscriber must be giving credit with positive probability to consumers because his payoff must equal the subscribers', and if the nonsubscriber finds it profitable to give credit with positive probability, it is most profitable to always give credit.

The Proposition enables us to use restricted payoff functions and to focus on the key variable of the model, X.

4.5 The Consumer's Decision

For case (1) of the Proposition, the consumer's decision is idle, as any behavior is a best response. (The perfect best response is to play (Default).)

For case (2), businesses are giving credit, subscribers are following the unrelenting punishment strategy, and there is a probability X that any given

business is a subscriber. Should consumer i pay her bill? The consumer will adopt one of two strategies:

The Cooperator strategy (C)—the consumer always pays her bill,

The Default strategy (D)—the consumer always defaults.

If consumer i plays (C) she simply gets (a) each period, so

$$P_i(\mathbf{C}) = a/(1-\delta q). \tag{1}$$

If consumer i plays (D) she will get A_i the first time she encounters a subscriber and zero every ensuing time, and she will get A_i every time she encounters a nonsubscriber. At the start of period 1, consumer i reasons that at any period t, assuming she survives until then, she wil meet a subscriber for the first time with probability $X(1\text{-}X)^{t-1}$ and will meet a nonsubscriber with probability $1-X$. Thus the present value of the expected single-period payoff in period t is $q^{t-1}\delta^{t-1}A_i[X(1-X)^{t-1}+(1-X)]$, and the sum over $t=1,2,\ldots,$ is

$$P_i(\mathbf{D}) = A_i \frac{[1-\delta q(1-X)]-\delta qX^2}{(1-\delta q)[1-\delta q(1-X)]}. \tag{2}$$

Consumer i will play (C) if $P_i(\mathbf{C}) > P_i(\mathbf{D})$, or

$$A_i < a\,\frac{1-\delta q(1-X)}{1-\delta q(1-X)-\delta qX^2}. \tag{3}$$

Letting $L(X)$ denote the RHS of (3), we can express the proportion of cooperating consumers as

$$\int_{\underline{A}}^{L(X)} g(A)\mathrm{d}A \equiv V(X) \in [0,1]. \tag{4}$$

Call $V(X)$ *consumer virtue*. Virtue is an increasing function because the larger the bureau the more dangerous it is to default:

$$V'(X) = \mathrm{d}V(X)/\mathrm{d}L(X) * \mathrm{d}L(X)/\mathrm{d}X = V(L) * \frac{a\delta q(2-\delta q)}{[1-\delta q(1-X)-\delta qX^2]^2} > 0.$$

Having determined consumers' best responses to a nonzero bureau with businesses giving credit, we examine in the following order the two choices of a business: whether to give credit and whether to subscribe.

4.6 The Business's Decisions

The supergame payoff to a subscriber where businesses are giving credit is represented by the function Subscriber-Credit (X):

$$\text{Sub-Cr}(X) = bV(X)\sum_{t=1}^{\infty}\delta^{t-1} - f(X)\sum_{t=1}^{\infty}\delta^{t-1}$$

$$- B(1-V(X))\sum_{t=1}^{\infty}\delta^{t-1}\left[(1-q)\sum_{i=1}^{t-1}[q(1-X)]^{i-1} + [q(1-X)]^{t-1}\right] \tag{5a}$$

$$= \frac{bV(X)}{1-\delta} - \frac{f(X)}{1-\delta} - \frac{B(1-V(X))[1-q[1+\delta-\delta q(1-X)-X]]}{[1-q(1-X)](1-\delta)[1-\delta q(1-X)]}. \tag{5b}$$

Interpreting (5a): The first term is the good-consumer factor; $V(X)$ of the time the business meets a good consumer and gets b. The second term is the bureau fee factor. The last is the defaulter factor; the business receives $-B$ from defaulters, which always make up $(1-V(X))$ of the population. However, thanks to the bureau a given defaulter cheats the set of members only once. The bracketed term in the summation captures the procedure of discovering consumers' types. Since new consumers are continually entering the system, businesses continue to suffer defaults.

When the sum of the good-consumer and defaulter factors are greater than zero, subscribers would do best as a group by giving credit. However, subscribers do not act as a group in regard to the credit decision. A business may balk at giving credit even when Sub-Cr(X) is greater than the bureau fee factor (which is a sunk cost). The subscriber might elect to "sit-out" for a few rounds because in the beginning he has no information on consumers. Given that consumer behavior is summarized by the probability of co-operating, $V(X)$, subscribers will give credit in the first period if and only if

$$bV(X) > B(1-V(X)). \tag{6}$$

When (6) does not hold they shrink from giving credit because of the negative expected one-period payoff, and as a result the bureau never accumulates any information, so subscribers constantly face the same problem. Thus we define the following restricted payoff function:

$$SP(X) = \begin{cases} \dfrac{-f(X)}{1-\delta} & \text{if } bV(X) < B(1-V(X)); \text{ otherwise} \\ \dfrac{bV(X)}{1-\delta} - \dfrac{f(X)}{1-\delta} - \dfrac{B(1-V(X))\,[1-q[1+\delta-\delta q(1-X)-X]\,]}{[1-q(1-X)](1-\delta)[1-\delta q(1-X)]} & \end{cases}. \tag{7}$$

In the first case subscribers simply experience the bureau fee factor. Otherwise they receive Sub-Cr(X), which is the lower expression shown in (7).

For nonsubscribers, we can define Nonsubscriber-Credit (X) where businesses are giving credit as

$$\text{Nonsub-Cr}\ (X) = \left[bV(X) - B[1 - V(X)] \right] \sum_{t=1}^{\infty} \delta^{t-1} \tag{8a}$$

$$= \frac{bV(X)}{1-\delta} - \frac{B[1 - V(X)]}{1-\delta}. \tag{8b}$$

By comparing (8b) and (5b) we can see the trade-off involved in bureau membership. The first terms of each, the good consumer factors, are identical. They differ in their defaulter factors, however, as the last term of (5b) is smaller in absolute value than the last of (8b). Collectively, the subscribers are taken only once by a defaulter. This advantage comes, of course, at a cost, the second term of (5b).

Whenever Nonsubscriber-Payoff $(X) < 0$, nonsubscribers would not give credit, yielding a supergame payoff of zero. If the reverse were true they would give credit and receive Nonsub-Cr(X), as expressed in (8B). Thus we define the restricted nonsubscriber payoff as follows:

$$NP(X) = \max \left\{ 0, \frac{bV(X) - B[1 - V(X)]}{1-\delta} \right\}. \tag{9}$$

We can now see that the first two directives of the bureau protocol (that is, reporting and accessing information) are self-enforcing. No subscriber would deviate from them even if he were able to. Reporting consumer credit performance is assumed to be costless. In real life this is typically automated and required by the bureau. The second directive, accessing an applicant's credit record, is assumed to be costless; the business would be eager to follow it because in equilibrium any defaulter would default again if given credit.

The difference between Subscriber-Credit (X) and Nonsubscriber-Credit (X) can be represented

$$D(X) = \frac{-f(X)[1 - \delta q(1-X)] + B[1 - V(X)]\delta qX}{(1-\delta)[1 - \delta q(1-X)]}. \tag{10}$$

Let $\Delta(X)$ denote the numerator of $D(X)$.

For $\{X | \Delta(X) > 0\}$ there is an incentive to join the bureau, provided that $SP(X) > 0$. For $\{X | \Delta(X) < 0\}$ there is an incentive not to join the bureau.

5. SEQUENTIAL EQUILIBRIUM

Our investigation of sequential equilibrium turns on the businesses' decisions of whether to join the bureau. Whether businesses give credit follows immediately from whether X is zero or positive. Consumers have no strategic leverage in

the model; their passive reactions to bureau size are summarized in the virtue function $V(X)$.

5.1 *Classes of Sequential Equilibrium*

Sequential equilibria always exist but may not be unique. We can divide equilibrium levels of X into three classes, each with their own necessary and sufficient conditions.

The N equilibrium (no subscribership). Since

$$D(0) = \frac{-f(0)}{1-\delta} \tag{11}$$

there is no sense in subscribing when no one else is, so a bureau of size $X^* = 0$ is always an equilibrium.

The T equilibrium (total subscribership). A bureau of size $X^* = 1$ is an equilibrium iff $SP(1) \geqslant 0$ and

$$\Delta(1) = -f(1) + [1 - V(1)]\, B\, \delta q \geqslant 0. \tag{12}$$

Condition (12) says that when businesses are giving credit, subscribers get a higher payoff than nonsubscribers, and $SP(1) \geqslant 0$ implies that at $X = 1$ businesses are doing at least as well as they would be doing as nonsubscribers not giving credit.

P equilibria (partial subscribership). A bureau size $X^* \in (0,1)$ is an equilibrium iff $SP(X^*) \geqslant 0$ and $\Delta(X^*) = 0$. The condition on $SP(X^*)$ ensures that subscribers are doing at least as well as they would be doing as nonsubscribers not giving credit. The condition $\Delta(X^*) = 0$ says that businesses are indifferent between subscribing and not subscribing. Given the positive effect X^* has on consumer virtue, the benefit to subscribers of access to consumers' credit records exactly equals the cost of subscription. If the relationship were not one of equality, there would be an incentive for nonsubscribers to join or for subscribers to quit the bureau.

5.2 *Stability of Sequential Equilibria*

Equilibrium bureau size may be classified not only by region—namely {[0], (0,1), and [1]}—but also by stability. Stability properties can help us judge which equilibria are reasonable, as stability properties will make certain equilibria better focal points (Schelling, 1960, 53–77, 111–15).[9] For a stable

[9] This notion of stability is much like the "recontracting" of Walras and Edgeworth and can be found in Schelling (1978, p. 226), Varian (1978, p. 186), and Atkinson & Stiglitz (1980, pp. 534–35).

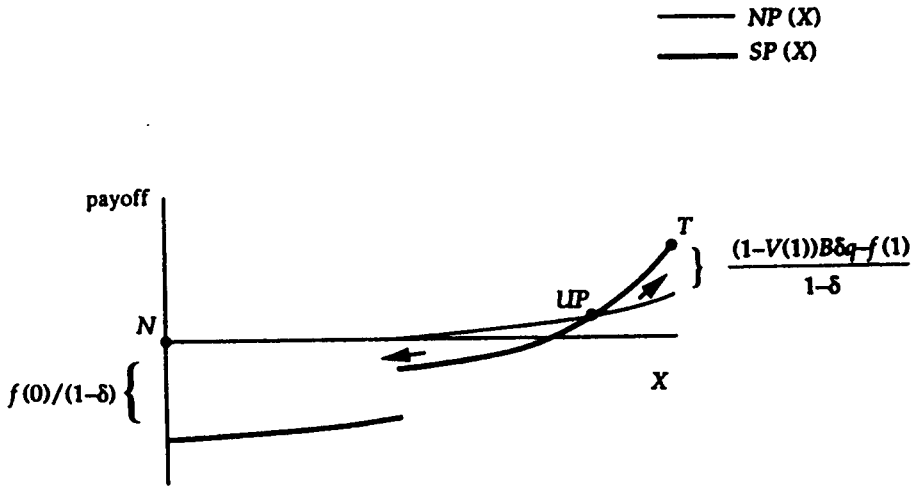


Figure 3.

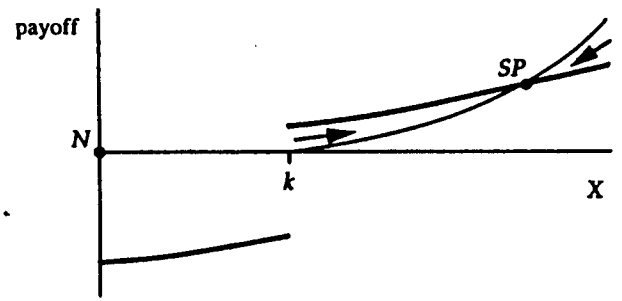


Figure 4.

X^*, local perturbations from X^* induce movement back to X^*. For an unstable X^*, decreasing perturbations induce further decreases in the bureau size and increasing perturbations induce further increases.

5.3 *Diagrammatic Representation*

By plotting $SP(X)$ and $NP(X)$ the logic of subscribership equilibrium and stability is made apparent. With an eye on Figures 3 and 4, realize that at $X=0$ no business is giving credit but subscribers are paying their bureau fees, so the thicker, subscribers' line, $SP(X)$, always begins at $-f(0)/(1-\delta)$ (the bureau fee factor) and the thinner, nonsubscribers' line, $NP(X)$, always begins at zero. Thus $N\,(X=0)$ is an equilibrium—to subscribe would be merely to throw away money on bureau fees—and N is stable since a small perturbation in bureau size would be reversed. Since society starts at N this equilibrium is a particularly important and likely one, even if it is suboptimal. (For Figures 3 and 4 equilibria are shown with heavy dots.)

Notice that $SP(X)$ displays a discontinuity, which occurs at the X value where $NP(X)$ rises from the abscissa. At this X, $V(X)b = (1 - V(X))B$, the point at which businesses begin giving credit. The $SP(X)$ line jumps up at this point because suddenly all subscribers become credit-grantors, generating information that is of value in future periods. For X's to the left of this point the first credit-granting period entails a negative expected gain, so all businesses refrain from giving credit (as discussed in Section 4.6).

Both $SP(X)$ and $NP(X)$ are nondecreasing, suggesting the possible inefficiency of N. In Figure 3 the gap between $SP(X)$ and $NP(X)$ closes, and there is an unstable P equilibrium where they intersect, UP. For X's to the left of UP businesses have the incentive to shun the bureau, driving X to the stable equilibrium N. Elsewhere the tendency is toward the stable equilibrium T. The question then is whether attention is focused on the region to the left or to the right of UP. This is where the suggestive power of an acknowledged coordinator—such as a chamber of commerce—can be critical.

Figure 4 displays another type of equilibrium. Again, it makes much more sense to say that a bureau will settle only at a stable equilibrium, either N or SP (for "stable partial"). At SP a majority of businesses subscribe while the rest choose to free ride on the consumer virtue generated by the subscribers. This configuration corresponds to the real world observation that a fringe of credit-granting businesses do not participate in credit bureaus.

6. WHENCE THE CREDIT BUREAU?

In Section 2 I stated three general settings for self-policing society: (a) tight-set repeated interaction, (b) the small community, and (c) the Great Society. The credit bureau can give people in a Great Society a system of incentives to keep promises. But the prospect of market failure looms large, since in its inception a credit bureau has nothing to offer. Society may well settle at an inefficient equilibria, especially since having no bureau is always a stable sequential equilibrium. As Schelling put it in his classic paper on binary choice with externalities, "[p]eople can get trapped at an inefficient equilibrium, everyone waiting for the others to [join], nobody willing to be the first unless he has confidence that enough others will [join] to make it worthwhile" (1978, p. 232). In this section I briefly describe how the start-up problem has been dealt with historically.

The start-up problem reflected in the model corresponds to difficulties in credit information sharing throughout history. Cole (p. 184) says,

> The first so-called credit bureau was organized as early as 1860 in Brooklyn, but credit bureaus grew and developed slowly prior to World War II. Prior to World War II, few retailers sold on credit . . .

Although credit was uncommon, credit would have conferred similar benefits to those it does today.

Consider a case like Figure 4. A viable credit bureau must assure businesses that at least a portion k will participate. Otherwise nobody wants to go first. It is doubtful whether entrepreneurial initiative could be relied upon to start a commercial bureau from scratch.

In the post-war period, before giants like TRW defined the credit reporting industry, credit reporting was a local affair. Retailers, banks, car dealers, and others in each town needed credit information. It was in the small community that the credit bureau was born, and it was precisely small town norms and institutions, like duty, loyalty, and business reputation (transmitted through gossip), that induced participation. Cole says,

> [i]n the past, most credit bureaus were community cooperative or nonprofit associations operated for the benefit of the users. Others were owned by local chambers of commerce, which operated them for the benefit of their members (Cole, 186).

Run as an association service, a bureau can make appeals for participation that it could not make if run as a business. Our model described only the economic incentives involved. Retail merchants' associations and chambers of commerce also offer legitimation to the community, social events, business exposure, representation in government, and so on. Olson (p. 146) says, "[t]hese local chambers of commerce are normally small groups, and on that ground can normally organize with relative ease. They are made the more attractive to members by the fact that they are good places for businessmen to make 'contacts' and exchange information."

Many local credit bureaus are still run on a cooperative basis, such as the primary bureaus of San Antonio and Tampa. Most, however, are in the hands of private business. But, in very few cases was a local credit bureau originally established by a private business. Usually a bureau was undertaken by a cooperative association and only later was transferred to private hands. TRW, in fact, first broke into the credit reporting business when it took over the Michigan Merchants' Credit Association.

Thus we see how the start-up problem has been dealt with in practice: small community incentives were used to deal with the free rider problem; after the major hurdle was cleared by virtue of nonprofit action, the enterprise was put in the more efficient hands of private business. This history tells us something about how the theory of cooperation in the small community—in this case, town merchants forty years ago—may play a crucial role in anchoring cooperation in a Great Society.

The pattern of amalgamation of local systems into a unified system also fits the development of the Law Merchant. As Trakman (1983, p. 8) says: "The mobility of the merchant carried with it a mobility of local custom from region to region. The laws of particular towns, usually trade centers, inevitably grew into dominant codes of custom of trans-territorial proportions."[10]

[10] It should be noted that the Law Merchant was a much more complex institution than credit reporting, and that its practice never achieved the degree of uniformity that credit reporting has; see Trakman (1983, pp. 18–20).

7. CONCLUSION

Using the tools of game theory this paper has constructed a model which captures basic aspects of credit reporting. Specifically, the bureau serves as a hub of information, efficiently transmitting information to its members. At the same time the credit bureau creates incentives for consumers to alter their behavior. In the spirit of the quotation that opens this paper, commerce promotes morality as though it were guided by an invisible hand.

For maintaining accountability and honesty in a vast society like the United States, the essential principle behind the credit bureau can be of great importance, as it appears to be to the credit-granting industries. In a Great Society the credit bureau plays a role that gossip plays in a small community, although in a much more discreet fashion.[11]

In addition to the effect on consumer behavior, the paper has explored at length the interaction of businesses. A bureau solves the dilemma of the credit stage-game, but forming a bureau may itself be a sort of dilemma. Historically, the Great Society institution of the credit bureau grew out of nonprofit credit information sharing in small communities. This history shows that inducements to good behavior can evolve from quaint, face-to-face beginnings to modern, impersonal information systems.

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