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Abstract: In this paper, we consider the costs and benefits of transactions privacy. In the environment we consider, privacy is the concealment of potentially useful information, but concealment also potentially bestows benefits. In some versions of the environment, the standard Coasian logic applies: given an unambiguous initial assignment of rights and sufficient flexibility in contracting, efficiency in information revelation will result. Coasian bargaining may be impeded, however, by either an inability to make certain commitments or by the presence of significant investments that must be made before the transaction occurs. In such cases, initial assignments of rights (for example, privacy laws) can have consequences for efficiency.

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A Theory of Transactions Privacy

1. Introduction

The seemingly inexorable technological progress in computing has lowered the cost and increased the speed of record keeping. Computers are now capable of maintaining and quickly searching vast information databases. With the arrival of the Internet, the costs of transmitting information nationally—even globally—continue to fall dramatically. Furthermore, the Internet has broadened the class of potentially available information available to include information stored on personal computers.

This rapid progress in information-handling technology has led to an equally extraordinary drop in the costs of certain transactions. Transactions that once required specialized intermediaries (e.g., travel agents, car dealers, or stockbrokers) can now take place directly between buyer and seller. Remote transactions that were once unthinkable—say, a household in Sydney ordering a computer from a California-based retailer with a factory in Taiwan—have become utterly commonplace.

If this "information revolution" has a dark side, it may be in the form of a concomitant loss of privacy. Just as progress in computing and communications technologies has lowered costs for "legitimate" uses of information, it is also lowered the cost of questionable or even fraudulent uses. The same consumer who is pleased to be able to buy a stereo system online, may be irked when he finds out that his financial records can be instantly accessed by anyone willing to pay a nominal fee. And he would no doubt be outraged if someone were to use this information to make purchases in his name. Yet the ongoing advance in informational technology has lowered the costs, and some would argue, increased the incidence, of all three scenarios.

The result has been a sharp increase in public debate about privacy issues, particularly on the issue of Internet privacy. Privacy advocates see privacy as a good in itself, an ability "…to enjoy one's peace and quiet" (Posner, 1981), that should be guaranteed through legislation. Others view privacy as "concealment of information," information which may be potentially valuable in the context of economic sorting and matching of tastes and opportunities (Stigler 1980).

In this paper we consider the costs and benefits of transactions privacy. In the environment we analyze, privacy is the concealment of potentially useful information, but concealment also potentially bestows benefits. We build a model by starting in a world in which the Coasian logic does indeed apply: Given sufficient flexibility in contracting, stringent privacy laws are unnecessary to achieve efficiency in the concealment or revelation of information.

Nonetheless we argue that there are important reasons why we should expect that contracting flexibility is limited in the context of transactions privacy. First, there are natural limitations on one's ability to commit not to use information once acquired—that is, "it's hard to forget." Second, the usefulness of information acquired is likely to be tied to a host of related investments by the transacting parties, contracts over which are themselves likely to be difficult to enforce. Consequently, we argue that choice of property rights will have implications for welfare and for the technologies ultimately adopted by participants in these markets.

Our model will consider a "canonical example" of an Internet-based transaction. The transaction is between a consumer *A* and a firm *B*, both of whom stand to benefit from the transaction. In addition, there is an outsider *C* who would benefit from knowl-

edge of the transaction between *A* and *B*. Revealing the transaction to *C* also affects the utility of *A* and *B*, however. In this simple example, revealing the transaction is socially desirable if and only if the resulting gain in utility by *C* outweighs any loss of utility suffered by *A* or *B*.

To make the example more concrete, suppose that the consumer wishes to purchase a high quality home sound system from some vendor. The knowledge of this purchase can be valuable to a variety of third parties. For example, vendors who sell goods that are complementary to the initial good—say music CD's—will be interested in learning of the purchase. Other parties have an interest in learning something about the transaction as well, including companies who survey consumer satisfaction, companies interested in learning the consumer's credit history—and thieves specializing in audio equipment.

In some cases the consumer would be eager for the third parties to learn about the purchase, as in the case of the seller of music CDs. In contrast, the consumer clearly prefers that the thief not be informed of the transaction. In other cases—telemarketers, credit rating agencies—it may be unclear whether the consumer is in favor of or opposed to the information release. Similarly there may be positive or negative benefits to the firm from the third party learning about a consumer. For example, the firm may gain from the release of the information if it has extended credit in the process of making the sale, or if the firm stands to reap additional benefits through follow up sales from the market research conducted by third parties.

In the context of the example, this first-best outcome would clearly obtain in a cooperative environment in which *A*, *B*, and *C* could freely enter into a multilateral

agreement concerning information release. But what can be said about more realistic, noncooperative environments in which neither *A* nor *C* knows of the other's existence prior to the transaction?

Consider the case in which *C* is an annoying telemarketer. If the vendor *B* owns the right to reveal *A*'s purchase to *C*, then in order to induce *A* to make a purchase, *B* must either sufficiently compensate *A* for the annoyance or contract away the right to reveal the transaction. Or, if the consumer *A* owns the right to reveal the transaction, the merchant and ultimately the telemarketer would have to compensate *A* before she would agree to cede this right (or *A* might end up paying a higher price to *B*, relative to the first case, in order to retain it). In either case, a first-best allocation would obtain with sufficient bargaining. Finally, the telemarketer *C* might own an option right to knowledge of all transactions involving *B*. A first-best outcome could again obtain, perhaps by transfer of some of the value of *C*'s option to *A*, or by ceding this option in return for compensation from *B*.

Sections 2 and 3 of the paper establish the implications of this model under full Coasian bargaining and under the natural restrictions on contracting that we mentioned above. Under the restrictions we examine, the initial assignment of rights could have economic consequences. In section 4 of the paper, we apply our model to a discussion of a variety of policy issues, among them, the effect of privacy rules on the choice of technology. The availability of technologies that assure the user of virtual anonymity strengthen the bargaining position of Internet transactors wishing to remain anonymous. In the absence of clear legal rights to privacy,[1] one can expect a race to develop tech-

[1] Currently, the rights to privacy over the Web are not well defined (with the arguable exception of the EU Privacy Directive), particularly in cases where transactions cross national borders.

nologies both to track and to conceal transactions.[2] One component of information-concealment technologies is a means of payment that, like cash payments in the physical world, do not produce records of the transaction. When privacy rights matter, we would also expect anonymous forms of transacting, including anonymous means of payment, to arise, as well as more and more intrusive forms of transaction-tracking technologies.

2. Model

All agents in the economy are risk neutral. The reservation level of utility for all agents in the case of no transactions is zero. There are two time periods. Consumer *A* and firm *B* have the opportunity in period 1 to conduct a transaction, or "deal" (which we will denote *d*).[3] Agents *A* and *B* receive certain, fixed levels of utility from the transaction itself, v_A and v_B, respectively.[4]

In addition there is a third party *C*, and the utility of agents *A*, *B* and *C* may be affected, not only by the deal itself, but from *C*'s knowledge of the transaction. More precisely, in the background are a large number of consumers who, from *C*'s point of view are indistinguishable from *A*; however the transaction is prohibitively undesirable to any consumer other than *A*. (For simplicity we will assume that *B* can distinguish *A* from all others and of course *A* knows his own identity. But neither *A* nor *B* has a credible way of directly revealing *A*'s identity to others.)

[2] Lessig (1999) discusses some implications of development of these technologies using computer "code."
[3] Here, the term "transaction" refers to any interaction having economic value. For example, a visit by an Internet user to a website may constitute a transaction, irrespective of whether the user purchases a good or service from the website.
[4] That is, the transaction has a discrete character in the sense that agents cannot vary these underlying payoffs. This abstraction may not be too severe if one again imagines that a "transaction" is simply a visit to a website.

The transaction between *A* and *B* occurs or not in period 1. In period 2, *C* has an option of taking an action with respect to one of the consumers in the economy (in various circumstances we will think of the action as sending a free sample to somebody, doing a background check on somebody, or breaking into somebody's house). The action is a hidden action; there is no way for the parties to write a contract on its occurrence or non-occurrence. If the action is taken with respect to someone who has not entered the transaction in period 1, then it is extremely costly to *C* and worthless to everyone else. If it is taken with respect to agent *A*, and *A* has entered the transaction in period 1, then *A* and *B* have utility levels $v_A + w_A$, and $v_B + w_B$, and agent *C* has utility w_C. We assume that $v_A > 0$ and $w_C > 0$, so that *A* always benefits from a private transaction, and *C* would always benefit from learning about the transaction. However, *B* may not always benefit from a private transaction, while *A* and *B* may or may not benefit from *C*'s knowledge of the transaction.

The details of the bargaining game are as follows: A transaction only takes place by mutual agreement between *A* and *B*. A fair coin is tossed between the two parties *A* and *B*, and the winner of the coin toss makes a take-it-or-leave-it offer to the other party concerning the division of rents arising from the transaction.[5] (Later we will allow other terms to be included in the bargain). The loser of the coin toss has strategy space $\{0,1\}$, i.e., the losing agent may either assent to the proposed transaction or not. There are no subsequent opportunities to transact. If the losing agent assents to the winning agent's offer, then the transaction is made, otherwise no deal occurs. In this bargaining, each

[5] More generally, the coin might be biased either way, according to the bargaining power of the two parties. For simplicity, we initially focus on the equal-bargaining-power case.

player receives the full gains to trade with probability ½, so in expectation, each of their payoffs is equal to one half of the gains to trade.

From *C*'s point of view, there are two crucial aspects to information at the time 2 when he takes his action: whether the trade has taken place, and the identity of agent *A.* For simplicity we will deal with deterministic information sets for agent *C*: *C* will always know whether or not the transaction has occurred. If it has not occurred, then of course *A's* identity is irrelevant; if it has occurred, then there are two possible signals: either *C* learns which consumer is *A* ("*C learns A"*) or all consumers look identical to *C*. ("*C doesn't learn A"*). Thus *C*'s information set F_C consists of the two signals, i.e.,

$$F_C = \{\text{"}C \text{ learns } A\text{"; "}C \text{ doesn't learn } A\text{"}\} \qquad (1)$$

If *C learns A* then *C* will take the hidden action; if *C doesn't learn A* then *C* will not take the hidden action. Thus the relevant aspect of any regime is the extent to which it does or does not encourage trade and to which it does or does not reveal the trader's identity to the third party. Table 1 summarizes the payoffs (not including any side payments from contracting).

Table 1: Payoffs to Agents

	Agent:		
Action:	*A*	*B*	*C*
No Trade	0	0	0
Trade: *C learns A*	$v_A + w_A$	$v_B + w_B$	w_C
C doesn't learn A	v_A	v_B	0

2.1 *Planner's problem*

Suppose a social planner can choose whether the transaction takes place and whether a public record of the transaction should be made. Then, the transaction takes place if the net sum of the gains and losses across agents is positive, and the transaction is publicized if the resulting gains to *C* outweigh potential losses to *A* or *B.*

Solution to the Planner's Problem:

d takes place and remains private if

$$v_A + v_B \geq 0 \text{ and} \tag{2}$$

$$w_A + w_B + w_C < 0; \tag{3}$$

d takes place and is made public if

$$v_A + v_B + w_A + w_B + w_C \geq 0 \text{ and} \tag{4}$$

$$w_A + w_B + w_C \geq 0; \tag{5}$$

Otherwise, d does not take place.

Implicit in the solution of the social planner's problem is a natural definition of the societal "value of information," which is the sum of the informational payoffs $w_A + w_B + w_C$. If this sum is negative, then its absolute value can be thought of as the societal "value of privacy."

2.2 *Public and Private Information Environments*

Below, we will consider equilibria of the bargaining game under a number of possible information revelation regimes. In all circumstances, *A* and *B* know whether the

transaction has occurred. Regimes differ in the circumstances under which *C* will be able to determine the identity of the transactors. A regime may (or may not) assign the right to control the disclosure of that information to one or another of the parties to the transaction. A crucial issue is whether the parties then have the ability to bargain over reassignment of disclosure rights.

We begin by considering two benchmark regimes. The first information revelation regime is "public information": *C* always receives the information. Next is "always-private information," in which the information about *d* cannot be made public (no one owns the right to disclose information).

Public information. Under a public information regime, the transaction occurs if and only if

$$v_A + v_B + w_A + w_B \geq 0 \qquad (6)$$

Here there are no side payments to or from agent *C* because no one can take an action to either release or withhold the information. Inefficiency can arise if (6) holds while condition (3) simultaneously holds, i.e., in cases where a transaction occurs but where information release is inefficient. Inefficiency can also result if condition (6) fails to hold while (4) holds, i.e., if information release is efficient but payoffs to *A* and *B* are by themselves insufficient to cause *A* and *B* to undertake the transaction.

If, on the other hand, contracting with *C* is allowed, then these sources of inefficiency may be eliminated. That is, *C* can offer to transfer some of its payoff from information release, if this is necessary for the transaction to occur. In such cases, *C* would compensate *A* and *B* for the value of their information. Or *A* and *B* can compensate *C* for giving up the right to receive information about the transaction, i.e., *A* and *B* could agree

to compensate *C* for the value of their privacy. Meaningful contracting with *C* in the latter situation would depend on the *C* being able to make a credible commitment to allow private information to remain private.[6] Such a commitment would appear to be difficult to implement, as it is difficult to "unlearn" information once learned, and it could also be difficult to conduct negotiations about revelation without the negotiations themselves revealing *A*'s identity.

Always private information. In this regime, the transaction occurs if and only if condition (2) holds. Analogous to the public-information case, inefficiency may arise if (2) is satisfied and there is a net social benefit to information release, or if (2) fails but (4) holds, so that a socially beneficial transaction does not take place.

2.3 *Sole-Source Information Environments*

Next we consider a regime that falls between the "always-public" and "always-private" regimes. In particular, consider a *sole-source* information revelation regime, under which the firm *B* has the right to release or withhold information about the consumer *A*'s identity. To fix ideas, think of firm *B* as *A*'s Internet service provider, who knows *A*'s identity. Think of firm C as an online advertiser.

Two versions of the sole-source regime need to be considered. In the first version, *B* cannot commit to withhold information from outsiders, whereas such commitments can occur in the second version.

[6] The recent Toysmart case (see Richtel 2000) illustrates the difficulty with making such commitments. Toysmart, an online retailer, offered its customers guarantees that information about their transactions would not be sold to third parties. When the firm ended up in bankruptcy, however, efforts were made to sell Toysmart's customer database as part of liquidation proceedings.

First consider the situation without commitment. Momentarily supposing that a transaction has occurred, we consider two cases in which information may be released. In the first case, $w_B \geq 0$ so that the payoff to *B* from information release is positive, and the information will be released if the transaction occurs. Thus, the transaction will occur under condition (6), as in the public-information case. In the second case, we have that $w_B < 0$, and $w_B + w_C \geq 0$. In this case, *B* and *C* will engage in bargaining concerning the release of the information. Each agent makes a take-it-or-leave-it offer with probability equal to ½. As a result, in this case, agent *B* will expect to receive $\frac{1}{2}(w_B + w_C) \geq 0$ in a side payment from *C*, to release the information. Hence the transaction will take place if and only if

$$v_A + w_A + v_B + \tfrac{1}{2}(w_B + w_C) \geq 0 \qquad (7)$$

Now consider a version of this environment in which *B* can commit to withhold information.[7] In this variation, the commitment to withhold or release the information is one of the potential terms in the bargain between *A* and *B*. Suppose that the contract between *A* and *B* makes the transaction and prohibits releasing information. Then the total value of the transaction to *A* and *B* is

$$v_A + v_B \qquad (8)$$

Suppose the contract between *A* and *B* requires releasing the information. Then the total value of the transaction to *A* and *B* is

$$v_A + v_B + w_A + w_B \qquad (9)$$

[7] In this particular case, it does not matter whether *B* has the right to release information unilaterally or must gain permission from *A* before doing so, as long as it is possible for *A* and *B* to negotiate compensation between themselves for the decision.

Suppose that *B* retains the option to disclose *A*'s identity to *C*. Then the total value of the contract is the same as before if $w_B > 0$ (so that the option will always be exercised). Otherwise it is

$$v_A + v_B + w_A + \tfrac{1}{2}(w_B + w_C) \qquad (10)$$

The negotiation initially chooses the largest of (8), (9), and (10) and splits this surplus between *A* and *B*. Note that efficiency is not necessarily attained under this arrangement. However, if the negotiation could also pre-specify the price which *B* would pay *A* if the information were released to *C*, then by making that charge equal to $w_B + w_C$ efficiency would be attained. The outcome is unaffected in this case by the decision to give initial rights for releasing the information to *A* or to *B*.

Thus, given sufficient flexibility in contracting, efficiency can be obtained under either a public-information regime or a sole-source information revelation regime. However, one could make the argument that the degree of commitment necessary for efficiency is higher in the public information regime. Under public information, the third party would have to be able to contractually commit to "blindfold itself" in cases where maintaining privacy is efficient. If such contracts were not feasible, then a policy case can be made for assigning consumers (or the firms they transact with) the rights to disclosure.

3. Reliance Investments

In practice, it is often necessary for a third party to invest large amounts to make use of the information to be gained from individual transactions. We call such investments "reliance investments." A case can be made in support of a public-information regime in environments where the outside party *C* must make such a reliance investment to

realize its payoff from information revelation. In particular, suppose that to realize w_C, C must undertake an investment at a cost of r_C in period 1, in anticipation of information revelation in period 2. We will assume that the net payoff from the reliance investment, defined as the gross payoff w_C^G minus the cost of the investment

$$w_C = w_C^G - r_C \tag{11}$$

is positive, so that information revelation is efficient if conditions (4) and (5) are satisfied. However, the fact that the investment must be undertaken in advance of negotiations between *B* and *C* can lead to a "hold-up" problem.

Suppose, for example that the public information regime is in effect. Suppose further that

$$w_A + w_B < 0 \tag{12}$$

$$v_A + v_B + w_A + w_B < 0 \tag{13}$$

so that no transaction will take place without negotiation with *C*. However, if (4) and (5) are satisfied it is efficient for a transaction to occur and for information to be released, so long as *C* undertakes the reliance investment. Hence a transaction may occur if *C* can agree to split some of the gains from information revelation with *A* and *B*. The net payoff to *C* from a 50-50 split of the surplus from the transaction would be however

$$\tfrac{1}{2}\left(v_A + v_B + w_A + w_B + w_C^G\right) - r_C \tag{14}$$

which in some cases would be negative and hence provide no incentive for *C* to undertake the reliance investment. In such cases the transaction would not occur.

While hold-up problems can occur under a regime of public information, they become more likely under a regime of sole-source information revelation. To see this, note

first that the previous hold-up example could also occur under a sole-source regime. Now consider a sole-source regime (with commitment) in which condition (6) is satisfied but condition (12) also holds, so that the transaction occurs but information release will not take place unless there is some negotiated deal with *C*. If condition (5) holds, release of information will be efficient. The net payoff to *C* from a 50-50 split of the surplus from information revelation would be given by (14). As in the example above, there are parameter values for which (14) would be negative, which would eliminate *C*'s incentive to undertake the reliance investment. Hence no information revelation would occur, even though revelation would be efficient.

To summarize, the model delivers mixed messages in environments where one of the transactors has the right to information disclosure. Given sufficient contracting flexibility, assigning disclosure rights to one or another of the transactors (such as the Internet service provider) can enhance welfare by facilitating transactions that might not otherwise occur. On the other hand, the assignment of disclosure rights to a transactor can lead to inefficient release of information when contracting is limited, and can also lead to inefficient withholding of information due to "hold-up" problems, in cases where outsiders undertake reliance investments.

4. Application to Public Policy Issues

4.1 *Internet Growth and Privacy*

To date, the privacy of Internet transactions has been largely unregulated. This lack of regulation has often resulted in revelation of users' identities to third parties. Although regulators have been reluctant to impose regulations on the Internet, there have

recently been a number of proposals for privacy standards. The effect of many of these proposals would be to shift the right of information revelation concerning Web-based transactions to the consumer. Proponents of "Internet privacy" claim that privacy guarantees are needed in order for consumers to have confidence in Web-based transactions, while opponents argue that such guarantee could impose undue costs on firms seeking to sell goods or services over the Internet.

Using a variation of our basic model, we will argue that there is a sense in which both proponents and opponents of Internet privacy may be right. In the initial development stage of the Internet, granting privacy rights to users may have been inefficient. However, we believe that it also the case that, as the Internet matures, efficiency considerations will weigh in favor of increased privacy rights.

Consider an environment in which both the consumer *A* and the information-acquiring firm *C* may undertake socially beneficial reliance investments. In particular, the reliance investment of the information-acquiring firm is socially beneficial, but its value depends upon information revelation that provides a negative payoff to the consumer. The consumer *A* may also undertake a reliance investment. The effect of the consumer's investment is merely to undo his negative payoff resulting from *C* obtaining information on *A*'s transaction with *B*.

This case is most easily analyzed when the firm *B* and the outsider *C* are merged into a single entity B'. If a transaction occurs between *A* and B', then it occurs in period 2. Payoffs are determined by bilateral bargaining. In the absence of investment, (gross) direct and informational payoffs to B' from transacting with *A* are given respectively by

$$v_B' = v_B \tag{15}$$

$$w_B' = w_B = 0 \tag{16}$$

Both A and B' may undertake reliance investments in period 1. Both reliance investments have positive social value. B' can undertake a reliance investment in period 1 at cost r_B', which raises B''s gross informational payoff to $w_C > 0$ and his net information payoff to

$$w_B' = w_C - r_B' > 0 \tag{17}$$

The downside of B''s investment is that it imposes a disutility $w_A^G < 0$ on A. In response, however, A can undertake a "privacy-enhancing" reliance investment at a cost r_A. Making this investment results in A's gross payoff from release of information to rise to 0 (that is, w_A^G changes to $w_A' = 0$). A then enjoys a net payoff rising to

$$w_A = -r_A + w_A' = -r_A > w_A^G \tag{18}$$

Suppose that private transactions are feasible (i.e., condition (2) holds), but that information release is efficient, conditional on B' undertaking his reliance investment, i.e.,

$$w_A + w_B' > 0 \tag{19}$$

If A's bargaining power is given by the fraction π_A, then net payoffs to both parties are given in Table 2 below.

Table 2: Payoffs Conditional on Reliance Investments

		If B'	
		Invests	Doesn't
If A	Invests	$\pi_A(v_A + w_C) - r_A$, $(1-\pi_A)(v_A + w_C) - r_B'$	$\pi_A v_A - r_A$, $(1-\pi_A)v_A$
	Doesn't	$\pi_A(v_A + w_A^G + w_C)$, $(1-\pi_A)(v_A + w_A^G + w_C) - r_B'$	$\pi_A v_A$, $(1-\pi_A)v_A$

From Table 2, it is clear that for both parties, incentives to undertake reliance investments will increase with bargaining power. For example, conditional on B' having invested, *A* will undertake his reliance investment if and only if

$$-\pi_A w_A^G \geq r_A \tag{20}$$

which from (18) must hold for π_A sufficiently close to unity. Likewise, B' will undertake his reliance investment according to whether

$$(1-\pi_A)w_C > r_B' \tag{21}$$

$$(1-\pi_A)(w_A^G + w_C) \geq r_B' \tag{22}$$

depending on whether *A* invests or not. (Note that if B' does not invest, then *A* will not invest.) From (17) and (19), conditions (21) and (22) will hold if the firm is given a sufficient amount of bargaining power, i.e., if π_A is sufficiently close to zero.

We can think of the question of assigning Internet privacy rights as a question of setting the consumer's bargaining power: the more "rights to privacy" the consumer is granted, the greater his bargaining power π_A. Note that if B''s reliance investment r_B' is relatively large, then the firm must be assigned most of the bargaining power in order for

(21) or (22) to hold. In this case, B' would have an incentive to undertake his reliance investment in period 1, the transaction will occur, and information will be released. The assignment of bargaining power to B' may cause condition (20) to fail, in which case the consumer fails to undertake his (socially valuable) reliance investment. While this outcome is inefficient, assigning more bargaining power to the consumer could violate one of the firm's incentive conditions (21) or (22), in which case the value of the consumer's investment falls to zero.

We believe that the above scenario is a plausible representation of the developmental stage of the Internet. Some initial limitation of consumers' privacy rights may have been desirable, in order to give information-acquiring firms sufficient incentives to invest in technologies to exploit the information revealed by Internet use. Assigning greater privacy rights to consumers could have delayed the development of such technologies by allowing consumers to "hold up" the information-acquirers.

As the Internet develops, however, efficiency considerations are more likely to weigh in on the side of increased privacy protections for consumers. Since the vast majority of the costs of manipulating electronic data are fixed, we would expect the per-user reliance investment r_B' to fall as Internet use expands, eventually to the extent where the incentive condition for the firm would no longer bind. At this point, an increase in the consumer's bargaining power π_A could increase efficiency by encouraging privacy-enhancing reliance investments.

4.2 *Technology Race*

Another way to influence outcomes in the scenario described above is by developing technologies, or computer code. For the firm, technologies that better track transactions will lead to easier and cheaper acquisition of the information, and more effective control of (and therefore rights to) the information. For the consumer, technologies that better conceal identity effectively grant the rights to privacy to the consumer, and thereby increase his bargaining power. As a result, we expect that a race to develop these antithetical technologies to occur. Arguably, more clearly defined and enforceable privacy rights can prevent this technological race from happening.

An illustration of these issues is given by a recent business case. Online advertisers commonly collect information on Internet users who visit websites that display their ads. Information gathered in this fashion is potentially useful to the advertisers but is generally insufficient to tie the identity of specific users (in the context of the model, "consumers") to specific website visits ("transactions"). In 1999, Doubleclick, a major online advertiser, acquired Abacus Direct, which maintains large databases collected on customers of mail-order retailers.[8] The information in the databases, when combined with the information already collected by Doubleclick, would have allowed Doubleclick to match up specific users to specific website visits. Doubleclick's purchase of the databases prompted a widespread outcry from Internet users, who contended that revelation of their identity would have violated their "right to privacy" over the Internet.

An interpretation of this episode consistent with the previous discussion is that Doubleclick was working to create a technology that would give it effective rights to information on transactions. If successful, the control of the technology would have granted

significant bargaining power to its owner, and would have increased the value of investments designed to exploit information gathered online. Over time, this might have increased users' incentives to develop identity-concealing technologies to thwart firms' ability to gather information.

A more reasonable approach, according to many advocates of Internet privacy, would be to allow users to make the choice as to whether their information could be collected by third parties. However, such an approach, as we've seen, has different distributional consequences depending on the ownership of alternative privacy technologies, and the bargaining power they confer. Assigning privacy rights to consumers could, in some instances, forestall a costly "arms race" in informational technologies. In other instances, it could simply raise the cost of providing services online.

4.3 *Money and Privacy*

An extensive literature in monetary theory (see e.g., Townsend 1989, Taub 1994, Kocherlakota 1998, Aiyagari and Williamson 2000) has emphasized the role of money as a record-keeping device. In effect, socially optimal allocations can sometimes be implemented by using money to "keep score." In many environments, it is unnecessary to employ more extensive record keeping to track the allocations since money provides a "sufficient statistic" for individual incentives to support the allocation. Kocherlakota and Wallace (1998) show that money will have a role whenever record keeping (thought of as a centralized set of accounts of transactions) is imperfect. The more costly and the more imperfect the available credit-based system, the greater the need for money. With the development of technologies such as the Internet, however, the costs of maintaining and

[8] Information on the Doubleclick episode is from Clausing (2000).

transmitting vast amounts of information are falling dramatically. Some might therefore argue that the low cost of Web-based information processing means that there will be no role for e-money—a technology that is the electronic equivalent of currency—as a medium of exchange.

A counter-argument would be that in addition to its value as a possibly imperfect proxy for credit, the value of money also derives from its imperfection. That is, the anonymity of money makes certain transactions possible that could not occur otherwise. This property of money is most often associated with various types of shady deals, but we will argue that it is of potential value in economic situations where there is an incentive for "outsiders" to exploit the information contained in individual transactions.

In the context of the model, we will think of money (including both the electronic and traditional kinds) as a technology that allows consumer *A* to anonymously conduct a transaction with firm *B*.[9] In other words, the availability of e-money would define an information revelation regime by assigning to the consumer the sole right to information revelation.[10] However, given sufficient flexibility to negotiate away from this default assignment, Coasian logic dictates that this assignment should not matter. Thus, for cash to have value, some barrier to Coasian bargaining is necessary.

The foregoing analysis suggests two potential impediments to bargaining that could give rise to the use of e-money. Suppose that the default assignment of rights is public information. The first type of barrier would be an inability of third parties to credi-

[9] In general, other technologies would be necessary to maintain one's anonymity on the Internet (such as "anonymous remailers," in addition to an anonymous e-money. For purposes of this discussion, however, we consider the bundle of technology needed to maintain one's anonymity to be provided together with e-money.

[10] This last statement assumes either that a form of e-money is declared legal tender, and must be accepted by the merchant, or that merchants voluntarily accept e-money as a means of payment, perhaps because it has already become widely acceptable by other merchants.

bly commit to surrender of their information. In this case it would be impossible for transactors to contract away from information revelation, even if privacy were efficient. The second type of barrier would be the presence of reliance investments. Suppose that privacy-enhancing reliance investments, as described above, were available to consumers, but that such investments were sufficiently costly as to be subject to a hold-up problem. If e-money were available, then the hold-up problem would be effectively remedied by the de facto reassignment of disclosure rights to the consumer that e-money accomplishes.

4.4 *Privacy Provisions of the Gramm-Leach-Bliley Act*

Title V of the Financial Modernization Act of 1999 (Commonly referred to as the Gramm-Leach-Bliley Act) contains a number of privacy provisions. Most notably, Title V of GLB (1) grants consumers a veto right over (the right to "opt out" from) a financial intermediary's ability to share information on a consumer with outside parties, but (2) allows such information sharing in cases where the information-acquiring firm is an affiliate of the firm collecting the information.

In the context of the model, we interpret these provisions of GLB as mandating one of two information revelation regimes. In the case where the information-acquiring firm *C* is not an affiliate of the financial service firm *B*, GLB bestows upon the consumer the sole right to information disclosure. In this case, the "sole-source" analysis of the previous section is applicable (recall that in our framework it does not matter whether *A* or *B* is granted the right to disclosure, in the case where *B* can commit not to disclose).

In the case where the information-acquiring firm *C* is an affiliate of the financial services firm *B*, GLB allows for complete information sharing between the two affiliates. In this "joint information acquisition" regime, the consequences of the GLB privacy provision depend on the degree of coordination between the two affiliates. If *B* and *C* have the ability to create perfect firewalls between themselves, then *B* may be able to make credible commitments to the consumer *A* concerning the release (or more crucially, the non-release) of information to its affiliate *C*. In this case one might think of the interests of *B* and *C* being seamlessly merged into a "joint interest," so that the standard rules of Coasian bargaining would apply, i.e., efficiency would obtain given sufficient flexibility. In this case, the contribution of GLB would simply be not to stand in the way of efficient contracting.

It may also be the case, however, that control of information-sharing between affiliates is less than perfect. If it happened that *B* and *C* each pursued their own separate interests, then the only effect of *C*'s affiliation, relative to non-affiliation, with *B* would be to diminish *B*'s ability to commit to withhold information from *C*. (Generally, it is easier to provide a guarantee of privacy outside of a firm rather than among different branches of the same firm.) In this case, the sole-source regime without commitment would be the appropriate framework for analysis, and the "information-sharing among affiliates" provision of GLB would amount to little more than a recognition that it is difficult to hinder information flows within a firm.

It should be pointed out, however, that the latter situation might actually be efficiency enhancing in cases where *C* must undertake reliance investments. That is, any welfare losses arising from *A*'s loss of privacy could be offset by the gains resulting from

a diminution of *B*'s ability to hold up *C*. Suppose, for example, that conditions (5), (6), and (12) jointly hold. As in the example given in the previous section, this implies that *A* and *B* would be willing to conduct the transaction, but that under sole-source information release *with* commitment, negotiation with *C* is necessary for (efficient) information release. If *C* must undertake a reliance investment in order for information release to be profitable, then the possibility of a hold-up arises. On the other hand, if *B* cannot commit to withhold information and $w_B > 0$, then *B* cannot credibly threaten to hold up *C*, and information is released. Relative to the case with commitment, *A* is disadvantaged by a loss of privacy, but overall welfare is increased.

These considerations lead us to conclude that the welfare effects of the privacy provisions of Gramm-Leach-Bliley are largely benign. If there is perfect coordination among different affiliates of financial firms, then GLB should not hinder efficient contracting. If financial firms cannot commit to limit inefficient flows of information among their affiliates, then GLB just recognizes this fact of life, and gives consumers an incentive to seek out unaffiliated firms.

5. Conclusion

We've examined a model focused on the issue of release of transaction information to a third party. This model allows us to consider issues related to the current public debate concerning privacy. By adopting the economic definition of privacy as being the ability to conceal information, our model has clear implications for defining the social value of privacy, and it delivers conditions under which we would expect various con-

tracting regimes to yield an efficient outcome concerning the release of transaction information.

This exercise has yielded some conclusions that are consistent with the Coasian view that sufficient bargaining flexibility among parties and clearly defined initial rights will lead to the first-best social outcome. While this is reassuring, it is not the end of the story. The current state of both law and technology do not always assign rights to transaction information unambiguously. As a result we expect that in many such cases, the initial or default assignment of rights affects the outcome, and can therefore lead to an inefficient result.

Our model also points out situations in which the bargaining among parties is likely to be impeded, either because of difficulties in making commitments, or because significant investments must be made before the transaction in order to utilize the resulting information. Because the party making the investment can't know who is likely to transact in the subsequent period, the investment can be treated as a sunk cost by the transacting parties at the time of the decision to release or not to release the information. Such a situation can also lead to inefficiencies in investment and in information release.

Murky rights to transaction information give incentives to parties to develop technologies that give effective control the information. Such effective control grants the controlling party enhanced bargaining power. As a result, we expect a technology race to create technologies both to conceal information, such as anonymous electronic-money, and to reveal information, such as the "cookie" technology so widely used on the Internet today. Clearly defining rights to control transaction information can short-circuit wasteful attempts to grab control of transaction information through costly technologies.

The subject of privacy rights will become more important as information-gathering technology continues to develop. Advances in that technology, if not matched by enhancements in low-cost information-concealing technology, generate the question of who should control the information. As more transaction information can be assembled, the issue becomes more acute. Our model provides a baseline to consider the issues involved.

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