Incentive Contracts

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1 Introduction

A critical feature of a contract is to shape incentives. A contract is an agreement that is intended to be enforced. My focus in the chapter is on externally or court-enforced contracts, as opposed to relational contracting. My primary aim is to present some practical insights that are meaningful for a wide range of disciplines and practitioners. I'll focus on hard evidence and verifiability as I believe these are important concepts that may not receive enough attention. I should note, for full disclosure, that these are areas on which my research has focused.

There is a rich economics literature on contract theory and game-theoretic models of information transmission and provision of incentives. This has resulted in many insights. These include the now familiar concepts of adverse selection, moral hazard, and signaling. These are commonly taught, in some form, in undergraduate game theory courses. The implications of these models provide powerful insights for many practical situations. Price discrimination is often studied by a monopolist, offering a menu of contracts, with one intended for a buyer with a particular valuation. Laffont and Martimort (2009), and Bolton and Dewatripont (2005) provide a thorough coverage of many aspects of economic contract theory. Many of these models are well known outside of economics and there are many texts that provide a thorough coverage; these are not covered here.

The chapter is organized as follows. In the next section, we'll consider some practical examples that highlight the importance of verifiability and incentives evidence disclosure for

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contracts. This will help illustrate how the evidence environment and incentives in evidence disclosure impact the scope for inducing incentives with a contract. In the following section, we'll turn to some results in the literature. Much of this will be in the context of the practical examples already discussed. The final section contains a brief discussion of the scope for empirical work.

2 Some Practical Motivation

Consider a transaction in which a buyer buys an object from a seller. Suppose the object is already made and the exchange of money and the object can occur simultaneously. An example might be a store selling a pencil, to a consumer in a cash sale. If the consumer has exact change, she could hand the money to the clerk at roughly the same time that the clerk hands the pencil to her. So, here, there is little need for an externally-enforced contract or to verify performance to a third party such as a court.

However, most transactions that create economic value or gains to the parties are not so simple, and require performance after the parties have reached an agreement. Most of these require some kind of external enforcement to shape incentives for parties to perform. Refer to the activity the parties take prior to the external enforcement as primary or productive activity. This is to make a distinction between that activity and activity during the enforcement phase of the interaction. In order for a contract to provide incentives to a party, there must potentially be a different court action following some productive activities than following others.

In order for the court to be able to take a different action following one productive activity, say outcome a, and another, say outcome b, it must be that the court has information that allows it to make a distinction between the outcomes a and b. Obviously, not all contract disputes go to trial. However, the anticipated outcome, should it go to trial, can influence the outcome of other resolutions, such as negotiation.

Parties to the contract convey this information to the court through the disclosure of evidence. So the incentives to disclose evidence are critical in understanding what incentives a contract can provide for productive or primary activity. In the context of the outcomes a and b example, the court cannot take a different action following a than following b if it does not have information about which has occurred. Naturally, this depends on the incentives of the parties to provide evidence. This is a key idea that we will explore later in this section and the next, but first let's consider some practical examples.

Consider a seller of a good who contracts for a delivery service to deliver the good to the buyer of the good. Suppose that timely delivery is of primary concern for the seller and the contract specifies the delivery service is to ensure delivery by date x. If the delivery service requires a signature from the buyer upon delivery and this is done in a way that documents the date, it is easy to verify that the delivery service has performed. One may be concerned about the scenario in which the delivery service attempts to deliver and the buyer is not at his home or business to receive the good. This could be dealt with by the delivery service taking a time-dated (and perhaps even location-marked) photo of the attempted delivery.

Naturally, there are examples where it may be difficult to verify performance. Suppose someone hires a piano teacher. The student and teacher agree that successful performance by the teacher is that the student will learn to play a particular song well. Since the student's improvement will depend on how much she practices and the instructor will not be present for all of that there is the possibility that the student meets the standard, but acts as though she does not. That is because someone who can play the piano well can also play it badly.[1] Of course, this involves the student behaving in a disingenuous manner and, in practice, piano teachers do not usually offer contracts of this type. Further, most music lessons have an ongoing nature to them and there is likely to be some form of relational contracting in addition to externally-enforced contracting.

There are other contractual situations where it is difficult to verify performance. These include construction or architectural contracts. Someone having a building built may not be able to verify whether the procedures used satisfy those specified. It is common for an engineering firm to be used to verify performance while construction is on going.[2]

Imagine a homeowner who needs to have the glass for an "impact window" replaced in his home. Impact windows are commonly used in hurricane-prone areas such as Miami, Florida. They are designed to withstand strong winds and flying debris. The standards in Miami-Dade County, Florida are quite stringent and acceptance of a window design for use as an impact window requires that the manufacturer submit testing and engineering documentation to the county.[3] Although the "impact glass' in such windows may crack, it is designed to not shatter so as to keep those inside of the dwelling safe. The glass is typically

[1]This example is based on an example in Lipman and Seppi (1995) that was originally suggested by Michael Peters.

[2]Chakravarty and MacLeod provide analysis of standard architectural contracts.

[3]This is obviously not intended to be a complete description of the details or standards one would want in purchasing or installing impact windows. As someone who lives in Miami-Dade County and who has had to navigate some of these issues for replacement of the glass in an impact window, I'm basing my discussion here on information from the Miami-Dade County Notices of Acceptance for various window manufacturers.

of a laminate construction and is made by the window manufacturer using polyvinyl butyral (PVB) interlayer. A homeowner who contracts with a window installer to replace a cracked glass in an impact window would not have a way of telling simply by looking at the glass whether it is suitable for the window. However, the installer could, potentially, provide documentation that suggests that the glass was manufactured by the original manufacturer of the the window and is similar to the glass that was originally in the window. One may view this as making it more likely that the glass is suitable.

So far, we've considered a series of examples that emphasize the importance of verifiability, using some sort of hard evidence, of either contract performance or lack of performance. Implicit to these examples is need for the party who possesses the critical evidence to have the incentive to disclose it. In most of these examples, this is the case. In the delivery of the good example, the delivery service certainly has the incentive to disclose the signature of the buyer indicating acceptance. Similarly, in the impact window example, the window installer clearly has the incentive to disclose the documentation on the replacement glass when it is suitable for the window. However, in the piano lesson example, the student may not have the incentive to demonstrate that she can play the particular song well, at least in the narrower version of the example, so as to avoid paying for the lessons.

This suggests constraints that beyond whether there is potentially evidence to prove performance or nonperformance, and suggests the importance of considering incentives in disclosing evidence. We explore this further in the next section. Next we consider the role for evidence and the importance of verifiability of productive actions in more complicated situations.

The band Van Halen was known for requiring that M&M candy, with no brown ones, be provided for them backstage at their concerts. This was not a rock band making outrageous demands, but instead actually had a verifiability component to it. As explained in Roth (2012) and Zeveloff (2016), the band had a very elaborate lighting and stage set up that was also specified in their contract.[4] If brown M&Ms were present, it was quite likely that the details of the lighting and staging had been missed, which potentially posed serious safety issues. The band's concert rider contained a clause specifying that if there were brown M&Ms the promotor would "forfeit the entire show at full price." David Lee Roth, the lead singer of Van Halen at the time, explained "Van Halen was the first to take 850 par lamp lights – huge lights – around the country. At the time, it was the biggest production ever. If I came backstage, having been one of the architects of this lighting and staging design, and

[4]See also Mikkelson (2001).

I saw brown M&Ms on the catering table, then I guarantee the promoter had not read the contract rider, and we would have to do a serious line check."

While the focus in the explanation for the brown M&Ms clause focuses on knowing whether a serious line check was needed prior to the concert, I suspect it also made it much easier to enforce should the situation end up in litigation. It's quite easy to document there were brown M&Ms, but it may be likely that the technical details of the lighting and staging would have been difficult to argue in court. There could potentially be some issue with how some evidence that may be presented would be interpreted by a jury. So the clause helped ensure verifiable evidence both prior to the concert when the deficiencies in the lighting and staging could be dealt with, but also for litigation should it come to that. One might note that the liquidated damage amount for the failure to provide M&Ms with no brown ones is quite extreme, which could pose an issue for a court actually enforcing it. In conjunction with a lighting or staging issue, the presence of brown M&Ms may provide a more convincing argument that the promoter had not read the concert rider in its entirety, which would make it more likely that the technical lighting and staging features had not been given adequate attention.

In a similar way, employers might specify some minimum performance standards that are easily verifiable and the failure to meet those may go along with the failure to meet other standards that are more difficult to verify. For example, a university may specify that faculty are to attend departmental meetings and seminars as part of its requirements for "service." While an academic department would typically expect much more than this for service, a faculty member who is unengaged and not participating in his department is likely to not attend meetings or seminars. This is quite easy to document. Whereas documenting that someone is not making a good effort on committee assignments or other tasks may be more difficult.[5]

It's worth noting that in some of these examples we have tended to focus on the case where evidence either exists or doesn't. In reality, evidence typically exists with different probabilities in different contingencies and rarely provides definitive proof that some set of contingencies occurred. Many of the previous examples have this aspect. As another example, a personal trainer being diligent in her work may make it more likely that her client will lose weight, but there is some positive probability, although lower, that her client will lose weight even if the trainer is not diligent. Refer to this type of evidence as *statistical*

[5]Others have pointed out the difficulty of fully describing standards in other areas of university and faculty contracts. The standard for tenure has received considerable attention. See for example Hart (1996). Cater, Lew, and Pivato (2009) suggest that faculty research may be a proxy for knowledge.

evidence. In these sorts of situations, the fact-finder, which could be a jury, will weigh the evidence to update its belief that a party performed or did not perform.

3 Contracts and Verifiability

I now present the previous ideas in the context of some economic models, continuing with an emphasis on practical ideas. Incentives can be provided through either a reward or a punishment – the so called "carrot" or "stick." We typically assume that economic agents weigh expect benefits against expected costs in determining how to behave. In this case, whether to perform as specified in the contract. This view fits with a Becker-type calculation by the parties to a contract.[6] Of course, this requires that the expected payoff differ following some productive actions. Since we are considering contracts, we would typically think of monetary transfers differing following some productive actions/outcomes.

In order for a contract to condition on some action or outcome, requires verifiability. Many economic models of contract assume some things are verifiable and others are not. See for example general moral hazard models, and team-production models such as those studied in Holmstrom (1982). Often this amounts to assuming verifiability is given by a partition of the action space of a production game. See, for example, Holmstrom (1982), Legros and Matthews (1993), Miller (1997), and Bernheim and Whinston (1999).

Importantly, the availability of hard evidence is a function of primary activity. Hard evidence can include physical objects such as documents, recordings, etc. These could also include witness testimony. These are possessed by an individual and disclosure decisions are inalienable. So an individual who possesses a particular document chooses whether to disclose it. This makes incentives to disclose evidence critical for being able to provide incentives in productive activity.

Let's begin with the case where evidence is realized deterministically. Here, the "state," which we use to refer to the profile of productive activity for each party to the contract, determines, with no randomness, the evidence that is available to each party. Thus, the available documents imply a subset of the states that may have occurred. The ideas here are from Bull and Watson (2004). Importantly, we assume that the court action is a transfer between the parties to the contract, and assume this must be "balanced" in that monetary resources cannot be added to or removed from the contractual relationship.

[6]Becker (1968) modeled a potential criminal as weighing the expected benefits against the expected costs of committing a crime. The expected punishment could be used to deter criminal activity.

Consider the following simple example as in Bull and Watson (2004). Suppose there are two states or possible productive outcomes: a and b. For simplicity, assume that the state is the result of only person 1's choice of productive action. Further, assume that the only hard evidence is the following. In state a person 1 possesses document d, and in state b person 1 possesses no documents. Person 2, the other party to the contract, never possesses any documents. This is represented below, with $\emptyset$ denoting when someone possesses no document.

State	1's Evidence	2's Evidence
a	d	$\emptyset$
b	$\emptyset$	$\emptyset$

Following Bull and Watson (2004), we would say that disclosure of d is *positive evidence* of state a, and non-disclosure of d is *negative evidence* of state b. Further, we say that person 1 can *positively distinguish* state a from state b. We say this because she has a document in state a that she does not have in b.

If we wish to have a different transfer following a than following b, we need for person 1 to have the incentive to disclose d when she possesses it. This requires that person 1's transfer following disclosure of d be higher than her transfer following non-disclosure of d. So this implies that person 1 must receive a higher transfer following a than she does following b. Note that this implies constraints on the transfers or court action that go beyond just the "partition" or those outcomes that evidence can distinguish between. If person 1 must undertake more effort so that b is realized, there is not a contract that can induce b.

Now suppose instead that both parties have the following similar evidence. In state a person 1 possesses document d_1 and person 2 possesses d_2, and in state b person 1 possesses document d_1' and person 2 possesses document d_2'. This is represented below.

State	1's Evidence	2's Evidence
a	d_1	d_2
b	d_1'	d_2'

Here, Bull and Watson say that each person (1 and 2) can *fully distinguish* a from b since she has a document in state a that she does not have in b, and vice versa.

In this case, there are not the kinds of restrictions discussed above. To see this, suppose we wish to have a transfer that favors one of the parties in state a relative to that in state b. As the transfer must be balanced, if it favors person 1, in state a, person 1 will disclose the document she possesses d_1 and in state b person 2 will disclose the document he possesses

d_2'. A similar logic applies if the transfer favors person 2 in state a. Here we also see that verifiability depends on the existence and non-existence of documents.

Since it nicely summarizes this point, I'll briefly describe the set up and main result, in a two-party version, from Bull and Watson (2004). They assume complete information between the parties to the contract implying each party knows the state. The timing is the following:

1. Parties contract – specify an externally-enforced contract that specifies the transfer as a function of evidence disclosed

2. The parties take their productive actions, which determines the state

3. The parties simultaneously and independently make evidence disclosure decisions

4. The court imposes a transfer, given the evidence that is disclosed.

A "transfer function" describes the transfer between the parties as a function of the state (not the evidence disclosed). If the parties can work out what incentives they need in primary activity, they would then like to be able to assess whether those incentives can be induced given the evidence environment. Theorem 1 in Bull and Watson (2004) provides guidance on this. It states that a transfer function is implementable if and only if for all possible states a and b, the transfer to person 1 in a specified by the transfer function is strictly greater than the transfer to person 1 in b specified by the transfer function implies that either person 1 can positively distinguish a from b, or person 2 can positively distinguish b from a, or both.[7] Returning to first example in which only person 1 potentially has a document following a, the result implies that we could not give person 1 to exert effort to induce b.

It's worth noting that court action as transfers and that the contract can specify the amount of transfers as a function of evidence has a clear role in the result. Being able to specify the transfers as a function of evidence fits with the mechanism design approach, and can be viewed as liquidated damages. In reality, the legal system imposes some constraints on this – both in terms of evidentiary rules and for the application of the legal rules to the facts of the case. However, I suggest the ideas concerning the role of positive and negative evidence and incentives in disclosure fit in a more realistic setting. For example, in *State v. Simons* the court based its decision on negative evidence. In that case, Simons was accused of selling spirits without a license. Simons' failure to present a license, although the state

[7]They also provide a version of this result for $n > 2$ players when an impervious to side contracting condition holds.

provided no evidence of a lack of the license, was held to be sufficient to conclude that Simons possessed no license.

Considering models that do not assume the ability of the parties to commit to transfers as a function of documents ex ante also allows us to see the importance of incentives in disclosure. It is common to model the fact-finder or jury as updating its belief about the true state when we do not allow for the ex-ante commitment to how evidence will lead to court action. Typically, it's assumed that the fact-finder wishes to choose the most appropriate action, given its updated beliefs. That is, the fact-finder behaves in line with society's interest. Economists typically use Bayesian updating.[8]

Let's now focus on statistical evidence. Focusing on just one party to a contract, that person may have unverifiable private information in addition to potentially having evidence. This private information corresponds to a person's *type*. At one extreme, this could be knowing the true state, which typically will not be the case as although someone may know her own actions, she may not know the legal standard or the actions of others. It's also possible that the private information is not fully informative, but provides some information. This private information is considered unverifiable because there is no hard evidence that allows it to be conveyed. The basic idea is that someone may not be able to prove everything she knows. A person's private information can influence her choice of whether to disclose a document that she possesses. Bull and Watson (2019) study the potential for evidence to be misleading in a single-litigant setting where the litigant has private information. The discussion here follows from that and focuses on their case where the litigant potentially possesses a single document.[9] This scope for evidence to be misleading can occur in other situations as well.

One way to view the different types, in a contractual setting, is that people may have different propensities to perform according to the contract. This litigant's behavior and, perhaps, some exogenous random forces lead to an outcome of preliminary activity, which can include whether breach occurred, relevant evidence, and whether the case goes to trial. It's possible that the litigant is at trial and did not breach the contract, and it's also possible that she did breach the contract. The two types of litigant are different people in society

[8]There is a large literature on Bayesian decision makers. There are two main approaches in this literature. One approach treats evidence as statistical in nature, but assumes it exogenously makes its way to the court. So it does not address individual incentives in the disclosure of evidence. Another approach models individuals' evidence-disclosure decisions, but assumes that the evidence can provide definitive proof of a subset of states. Shin (1994) is a classic example of this.

[9]The multiple document case gets quite complicated and the main point can be made in a relatively simple model.

and their personal backgrounds, to the extent not observable to the court, are represented by their types.

Since the litigant has private information, her disclosure decision has two channels of information. The first is a *face-value signal* based only on the statistical properties of the evidence (and not on the disclosure behavior of the litigant). The second is a signal of the litigant's private information since her disclosure decision is a function of her private information. As members of a jury do not regularly engage in fact-finding activity, the jury may not correctly anticipate the litigant's behavior as a function of her private information (the litigant's strategy in game-theoretic terms).[10] This means that in some cases, the jury may misinterpret the disclosure or non-disclosure of the document, and update its belief in the wrong way. There is scope for this happening when the litigant's private information is informative relative to the hard evidence. However, when the hard evidence is strong relative to the litigant's private information, there is not scope for evidence to be misleading. These ideas are an important consideration for contracting parties as this suggests limitations on the incentives that a contract can provide that go beyond just positive and negative evidence.

To get some intuition about the result, let's consider a criminal litigation example from the Bull and Watson (2019) paper. It has a defendant who is accused of robbing a store at 10 p.m. on a particular night. The hard evidence in question is a video recording of him on a security camera at a sports stadium across town that is time-stamped as 9:20 p.m. on the same night. Suppose that traffic was such that the accused could have left the stadium by 9:25 p.m. and speed across town to have arrived at the store by 10 p.m. Perhaps the defendant being on the security camera video is more likely when he is innocent. This would suggest that the face-value signal implies the jury should update so as to put more weight on the defendant being innocent. If this face-value signal is strong relative to any private information the defendant might have, when the recording is disclosed the jury should always update so as to put more weight on the defendant being innocent, and, thus, the defendant will always disclose the recording when he has it.

However, imagine a scenario in which a sophisticated criminal goes to the sports stadium and makes sure to get on the security camera before robbing the store. If the jury thinks this type of criminal would disclose the recording and the innocent type would not, it will update so as to put less weight on the defendant being innocent when the recording is disclosed. If the jury does this, but the innocent defendant always discloses the recording and the guilty one never does, the jury updates in exactly the opposite direction that the behavior of the

[10] As such, the coordination of beliefs and strategies needed for equilibrium is not likely to be attained. So Bull and Watson consider rationalizability as a solution concept. See their paper for the formal details.

defendant suggests.

This idea suggests that in contract situations, the parties should think carefully about the scope for misleading evidence should a dispute arise. Let's return to two of the practical examples from the previous section. Consider the example of a university faculty member who is accused of not performing adequate service for his department. If the document provided by the university is an email in which the faculty member declined to serve as chair of a particular committee, there may be multiple interpretations of this. It may be that the faculty member declined because the role was not a good fit for him, perhaps because he has had some conflict with others who are on the committee, and he is engaged in other ways. However, it may be that the faculty member is just unengaged in service to his department. The jury, should it get to that, might think that the university is presenting this as evidence because they don't have a very strong case. However, it could also be that the faculty member is unengaged, but this is the only hard evidence the university has. So this could be interpreted two different directions. It's worth noting that this document by itself isn't that strong of evidence.[11] As noted above, this may be a reason for a university to specify some easy to prove things, the failure of which is strongly correlated with a lack of service, as required for service.

Returning to the Van Halen brown M&Ms example, suppose that such a clause was not in the contract, and during a concert there was a significantly disruptive lighting malfunction. Further suppose the dispute over this went to litigation. Assuming, the malfunction did not cause injury, it's likely that the set up would be torn down to move to the next show and the venue may also prepare for its next act so testing of the electrical system made available for the lighting for Van Halen's show may not have been that feasible. Per Mr. Roth's statements, the band's rider contained very specific details about the amperage of outlets available. One sort of hard evidence that might be available would be an expert's testimony about whether failure to follow the specifications in the rider was likely to have caused the malfunction. This sort of testimony would like also contain a lot of technical details about the lighting requirements. There's the possibility for the jury to misinterpret this. Potentially, the jury could think that when it's likely that the issue was caused by the band's lighting equipment, instead of the of the venue not being properly prepared, the band would present such hard evidence. The presence of brown M&Ms would strengthen the likelihood that the promoter didn't read the rider, and hence the venue wasn't properly prepared. Bull and Watson (2019) also study the role for requiring multiple documents to

[11] It's also worth noting that, fortunately, most faculty members understand the importance of service to the institution.

be disclosed together so as to avoid the scope for the jury being misled by evidence with a weak face-value. This example fits. In addition to protecting the band and its people from potential safety issues and providing scope to fix problems before the concert, it may also have helped with potential litigation issues.

Much of the economics literature that models a cost of evidence focuses on the costly search for evidence once the dispute proceeds to litigation. I would suggest, instead, that a focus on primary activity that makes it more likely that hard evidence is available may be more useful for practitioners.[12] Additionally, there is scope for catching some issues that arise and having them corrected while there is still scope for joint gains being realized. This would fit with the building contracts and Van Halen examples.

There is quite a bit of work on sequential disclosure. See, for example, Bull and Watson (2007), Denekere and Severinov (2008), and Lipman and Seppi (1995). Additionally, there has been recent work on cross-examination by Fluet and Lanzi (2018).[13]

4 Empirical Work

It's natural to wonder what empirical research there is in this direction or what empirical work could be done. A challenge in this direction of research is there are typically not data available that allow us to know whether someone has breached a contract (or, similarly, is guilty in a criminal setting). So this poses a challenge. As a researcher who has focused on game-theoretic models of these issues, I will suggest that this limitation makes theoretical study quite important. However, as one who advocates updating beliefs based on hard evidence, I would like to do some empirical work in this direction. Experimental studies, where subjects are presented with situations and incentives are created, are likely to provide some important insights and some scope for testing some of the theoretical findings. My own research agenda includes some of these studies with coauthors. Certainly, the legal psychology literature has made good use of studies in this direction.

One potential source of data are contracts that must be filed and are publicly available. While these will generally not provide information about any disputes arising from such contracts, they may provide insights about how the parties structure their contracts. There are several papers that have made use of contracts filed with the Securities and Exchange

[12] My research plans include this sort of analysis. Some of my previous work has considered scope for the suppression of evidence and also a moderate cost of disclosure. See Bull (2008a), Bull (2008b) and Bull (2009).

[13] Fluet and Lanzi's model has a scope for two channels of information.

Commission (SEC) as part of the filings required for publicly-traded companies. These obtain contracts from the SEC's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system, and then typically. Then an application can be used to count or analyze key words in the contract, and this data can be used in regression analysis. See Schwartz and Watson (2013) and Moszoro, Spiller, and Stolorz (2016).

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