ON THE MISUSE OF THE NASH BARGAINING SOLUTION IN LAW AND ECONOMNICS

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August 2004

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Abstract: Bargaining plays a very important role in a great deal of legal scholarship, particularly in law and economics scholarship. Scholars often assume that the Nash bargaining solution determines the bargaining outcome, where the parties equally split the joint benefit created by the agreement. This solution, however, is inappropriate when parties have outside options, alternatives that only provide a payoff if the bargainer terminates the original bargaining. Most legal bargaining problems involve outside options. This article explains why the Nash bargaining solution generates an inappropriate outcome in this situation. Then, it examines several different prior articles that have used the Nash bargaining situation even though the bargaining problems these articles analyzed involved outside options. In particular, it demonstrates how the results from those articles would differ had they used a bargaining solution that was more appropriate for the situation they were analyzing. Finally, it argues that law and economics scholarship could benefit from a more careful modeling of bargaining problems.

I. Introduction

Bargaining plays a very important role in a great deal of legal scholarship, particularly in law and economics scholarship. Often the arguments and results of this scholarship are quite sensitive to the assumptions a scholar makes about how parties bargain. The most common assumption one sees is that parties share the joint benefit (or surplus) that coming to an agreement provides over what the parties payoffs would be in the absence of an agreement. Sometimes scholars are agnostic about the fraction of that joint benefit that a particular party obtains, but quite often they assume that the joint surplus is shared equally between the parties. This assumption is often justified by an appeal to the equal bargaining power of the parties or to the Nash bargaining solution—a cooperative bargaining solution that John Nash derived from a set of axioms that he felt any bargaining solution should satisfy.[2]

Of course, the bargaining that law and economics scholars are typically analyzing is not cooperative. The typical assumption is that each party is bargaining to maximize her payoff. Thus, the appeal to the Nash bargaining solution (or any other split of the bargaining surplus) is only reasonable if there is a realistic non-cooperative bargaining game that gives the same solution. The economic theory of bargaining has studied the question of when this is the case. Ariel Rubinstein has shown that in a game where two parties make alternating offers over how to share the surplus that they will obtain if they agree, that if both parties are equally patient (in

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[2] John Nash, *The Bargaining Problem*, 18 Econometrica 155 (1950).

terms of their willingness to delay an agreement) and offers can be made very frequently that the only reasonable outcomes is an (approximately) equal split of the surplus.[3]

An important feature of Rubinstein's bargaining problem however, is that neither party has an alternative to the agreement that gives her a superior payoff to disagreement. This is typically *not* the case in most legal applications of bargaining. When parties are bargaining over the how much to settle a lawsuit for, the plaintiff has the option of taking the case to trial to try to obtain an enforceable judgment against the defendant. When contracting parties are bargaining over a modification to a contract, at least one party will have the option of breaching and paying damages. When a husband and wife are bargaining over marital rights and responsibilities, each has the option of obtaining a divorce. These are just a few examples of the alternative options available to bargainers in legal situations.

The important thing to notice about all these examples is that (at least in many plausible circumstances) for one party to actually take advantage of her alternative option, she must terminate her bargaining with the original party: there is no reason to bargain over marital rights and responsibilities once the couple is divorced. In the language of the economic theory of bargaining, this makes these alternatives outside options. Some alternative options, however, are disagreement points (or inside options). These are options that a bargainer can take advantage of while still maintaining the possibility of reaching an agreement. For example, consider the case where parties are bargaining over the payment one will make to the other in exchange for the lifting of an injunction. The party with the right to the injunction can enjoy the benefits of the

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[3] Ariel Rubinstein, *Perfect Equilibrium in a Bargaining Model*, 50 Econometrica 97 (1982). Also, see Ken Binmore, Ariel Rubinstein, and Asher Wolinsky, *The Nash Bargaining Solution in Economic Modeling*, 17 Rand J. of Econ. 176 (1986).

injunction (precluding the other's harmful activity), while still preserving the joint gain that might be available if the injunction were lifted.

The economics of bargaining has recognized that these two different types of options (outside options versus inside options) have very different effects on bargaining outcomes. The Nash bargaining solution is quite similar to the non-cooperative equilibrium for a bargaining game where the parties have inside options. For outside options, however, the bargaining equilibrium for a non-cooperative alternating offer bargaining game is very different from the Nash bargaining solution. A great deal of legal and law and economic scholarship, however, has ignored this distinction. In this essay, I explain the difference between the bargaining outcomes produced by inside and outside options and then discuss several recent law and economics articles that have ignored this distinction and explain how the arguments in those articles would be different had they used the correct bargaining solution. By so doing, I hope to convince legal scholars of the importance of carefully modeling the bargaining process rather than simply relying on the shortcut provided by the Nash bargaining solution.

To illustrate the subtleties involved in determining whether parties have inside or outside options and the effect this has, I will often use a recent article by Ian Ayres and Kristin Madison [4] (though I discuss several other articles that (mis)use the Nash bargaining solution as well). I focus on this article for two reasons. First, its use of the Nash bargaining solution is fairly typical of the law and economics literature. Second, because it discusses both cases where parties have inside options and where they have outside options, it provides an excellent

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[4] Ian Ayres and Kristin Madison, *Threatening Inefficient Performance of Injunctions and Contracts*, 148 U. Pa. L. Rev. 45 (1999).

opportunity to illustrate the factors that determine whether an option is an inside option or an outside option.

In Ayres and Madison's article, they examine two broad classes of situations where a party may threaten inefficient performance of a legal duty in the hopes that this threat will enable her to extract a greater payment from (or reduce the payment she must make to) the other party.

1. A potential plaintiff might ask for equitable relief rather than damages not because she values this relief more than the damages she expects the court to award but, because she expects that by doing so she can induce the defendant to pay her more to waive this right to equitable relief than she could obtain from court awarded damages.

2. A defendant can inefficiently threaten to perform its duty so as to negotiate a settlement that relieves her of the responsibility to perform the duty in exchange for a payment to the plaintiff that is less than the damages the plaintiff could have obtained had he sued the defendant for non-performance.

As Ayres and Madison point out, in these situations threats of inefficient performance will only have the desired result if these threats are credible. That is, if the threatened party actually believes the threatening party will carry out her threat if she does not agree to pay her more or receive less than what a court would have ordered. Naturally, analyzing the credibility of these threats requires some assumptions about how the bargaining between the two parties will transpire. Ayres and Madison assume that the bargaining outcome will be given by the Nash bargaining solution (or the generalized Nash bargaining solution). As I discuss in more detail below, however, the Nash bargaining solution gives a sensible answer only for reversible, as opposed to irreversible, threats of inefficient performance because reversible threats generate inside options while irreversible threats generate outside options. In an appropriately specified bargaining model, then, inefficient threats of irreversible performance do not allow a party to

obtain a larger payoff than she would have received had she actually performed (or required the other party to perform) as threatened. This is due to the outside option principle: if one party has an outside option, only affects the bargaining outcome if the party's payoff from taking her outside option exceeds what she would have received from the bargaining without the outside option. In this case, the outside option is said to be binding and the bargaining outcome has the party with the binding outside option receiving a payoff from the agreement that equals the payoff from her outside option, while the other party receives the remainder of the bargaining surplus. If a party's outside option is not binding, then the bargaining outcome is the same as it would be if she had no outside option at all.

The implication of this is that only some of Ayres and Madison's examples are likely to be problematic, while others are not. In particular, while threatening not to lift an inefficient injunction is credible (provided the injunction, once issued, can later be lifted so that the efficient activity can continue), threatening to force specific performance, when such performance is inefficient, is (often) not a credible threat because it is (often) irreversible. Thus, we usually need not fear that a plaintiff will opt for a specific performance damage remedy simply to extort a higher payment from her contracting partner. This distinction is quite important since it suggests that while courts should seriously consider Ayres and Madison's potential solutions to the problem of threats of inefficient performance when these threats are reversible, such solutions are unnecessary and/or unhelpful if the threat is irreversible.

To illustrate the difference between reversible and irreversible threats, or inside and outside options, consider the simple example of bargaining over the sale of a house. A seller has two possible alternatives to selling the house to a given buyer. The seller can continue to live in the house herself or she can sell it to another buyer. The benefit the seller derives from living in

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the house is an inside option since she can enjoy this benefit while still bargaining with the original buyer. If the seller has an offer from an alternative buyer, this is an outside option since the seller cannot actually collect the payment from the alternative buyer unless she terminates bargaining with the original buyer. Applying this distinction to threats of inefficient performance, notice that the value a plaintiff obtains from an injunction against some activity X is an inside option since she obtains her utility from the absence of activity X while she is bargaining with the defendant over a payment in exchange for lifting the injunction.[5] On the other hand, specific performance is an outside option for a plaintiff because she only obtains utility from specific performance after the defendant has, in fact, performed the contract, at which point it is too late to bargain over waiving the defendant's obligation to perform.[6]

Consider an example Ayres and Madison use, a stylized version of the facts in *Peevyhouse*.[7] In this case, a miner has promised to return the topsoil on a farmer's land to its original position. Ayres and Madison assume that doing so would cost the miner $30,000. If the miner does not return the topsoil, then the land's market value is $10,000 less than it would be if the topsoil were returned. Imagine that, because the farmer is not planning to sell the land, that he only values having the soil returned at $8,000. Further, assume that if the court awards monetary damages, it will award the plaintiff $10,000 to compensate him for the diminution of

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[5] Of course, this is only true if the injunction does not eliminate the defendant's ability to benefit from the activity in the future. This could happen, for example, if an injunction permanently drives away the defendant's customers to alternative suppliers.

[6] Specific performance could sometimes be reversible threat. If the defendant's obligation is of a continuing nature, then the plaintiff and the defendant can still bargain over terminating the defendant's performance while such performance is underway. I will discuss this issue in more detail below.

[7] Peevyhouse v. Garland Coal & Mining Co., 382 P.2d 109 (Okla. 1962).

the value of his land. On the other hand, if the court awards specific performance, it will cost the defendant $30,000 but only benefit the plaintiff by $8,000. Because of this, a specific performance award creates scope for bargaining between the plaintiff and defendant. If the defendant pays the plaintiff any amount between $8,000 and $30,000 in exchange for the plaintiff waiving his right to specific performance, both parties will be better off.

The question, then, is how much the defendant will agree to give the plaintiff. Ayres and Madison assume that the Nash bargaining solution determines the amount of this transfer. In this simple bargaining problem, the Nash bargaining solution has the plaintiff and the defendant getting their disagreement payoff (what they would get if they could not agree to waive specific performance) plus an equal split of the total surplus that the agreement generates. The total surplus is simply the difference in the payoffs of both parties if they agree not to enforce specific performance versus what their total payoffs would be if they did enforce specific performance. Since specific performance costs the defendant $30,000 but only benefits the plaintiff by $8,000, agreeing to waive specific performance increases total surplus by $22,000. Thus, under the Nash bargaining solution, the defendant gives the plaintiff an amount such that each one is $11,000 better off than he would be if they did not reach an agreement. This means that the defendant must pay the plaintiff $19,000 ($8,000 + $11,000).[8]

Notice, however, that in this case, specific performance is an irreversible action. Once the defendant has returned the topsoil, there is nothing left to bargain over.[9] Since this

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[8] At other points in their paper, Ayres and Madison use a generalized Nash bargaining solution where the plaintiff obtains a fraction α of the surplus generated by the agreement, where α can be anywhere between zero and one. In this formulation, the parameter α serves as a measure of the plaintiff's bargaining power.

[9] Of course, returning the topsoil can be done in stages. But, as I show in Section II, as long as there is a last act of performance, that is, as long as performance is not a continuing duty, it is an irreversible threat. In *Peevyhouse*,

irreversible action is worth only $8,000 to the plaintiff, as long as the defendant has offered the plaintiff at least $8,000 to waive his right to specific performance, the plaintiff has no incentive to enforce the provision.[10] Thus, the defendant can make the farmer's threat of forcing specific performance not credible simply by offering to pay him at least $8,000 in exchange for waiving this right. Furthermore, once the defendant has made such an offer, he gains nothing by reaching an agreement with the plaintiff more rapidly. As long as bargaining continues, the defendant does not have to actually pay the plaintiff anything, nor does he have to spend any money to return the topsoil. This means that no matter how the plaintiff responds to the defendant's offer of $8,000, the defendant has no reason to ever offer anything more than this. As a result, the best the plaintiff can do is to accept the defendant's offer of $8,000 immediately.[11] Thus, if the court awards the plaintiff the right to specific performance, then the plaintiff cannot obtain $19,000

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there is a clear point at which performance is completed, making performance irreversible and an outside option. The important factor that makes a threat irreversible is if carrying out all or part of it reduces what needs to be done in the future. Since there is only a finite amount of topsoil to be returned, every bit of topsoil that is returned reduces the amount of topsoil that is left to be returned. Compare that with an obligation to deliver coal on a continuing basis. Prior to delivering coal this month, the coal company must deliver coal every month for an indefinite period of time. If the coal is delivered, one month later the parties are in exactly the same position as they were before the delivery of that month's supply of coal.

[10] Throughout this article, I will assume that when one party (X) makes an offer, call it M, which gives the other party (Y) exactly the same payoff as it would get from inefficient performance, Y will accept this offer. Obviously, to insure that Y is not indifferent between the two options, one could say that X needs to offer slightly more. For ease of exposition, I just say that X offers M rather than M plus one penny or one dollar.

[11] This argument does not require that the defendant can make a firm offer that the plaintiff cannot destroy. It does require that the plaintiff cannot exercise her outside option of enforcing specific performance until after the defendant has had an opportunity to make a counter offer. I discuss this issue more fully in section II.

from the defendant, or even the $10,000 that the court would have awarded in monetary damages. Because specific performance is an irreversible threat, it operates as an outside option, so the plaintiff cannot hope to obtain any payment in excess of the value he places on specific performance.[12] So, if the farmer insisted on specific performance, the court has little reason to fear that he is doing so to extort a greater payment from the defendant. It is far more likely that he is doing so because the value he places on the having the topsoil returned does exceed $10,000.

Specific performance need not always be an irreversible threat. When a contract requires a continuing duty, a plaintiff can enforce specific performance and then later bargain over the waiving the defendant's ongoing obligation to perform. During this bargaining, however, the defendant must continue to perform its obligation. Ayres and Madison's citation of Judge Posner's refusal to award a coal seller specific performance is an example of just such a case. The coal seller asked the court to force its buyer to continue to purchase coal from it as directed under the contract.[13] Because this contract specified an ongoing purchase obligation, had Judge Posner awarded specific performance, the coal seller would be able to continue to earn its profits from the contract while negotiating with the buyer to terminate the contract. Thus, in this case specific performance is an inside option, rather than an outside option, making the Nash bargaining solution an appropriate solution concept for this bargaining game. As a result,

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[12] All this assumes, as do Ayres and Madison, that the defendant knows that the value the plaintiff places on specific performance. If the defendant does not know the value the plaintiff places on specific performance, it is possible that he would be willing to offer more than the utility she receives from specific performance to reduce the probability that the plaintiff will find the defendant's offer insufficient and will actually insist on performance. I discuss this issue in more detail in section IV.

[13] Northern Ind. Pub. Serv. Co. v. Carbon County Coal Co., 799 F.2d 265 (7th Cir. 1986).

awarding specific performance in this case would give, as Judge Posner said, the coal seller

bargaining leverage to extract a greater payment from the buyer than the buyer would be able to

obtain from damages alone.

Of course, one might think that the distinction between inside and outside options is too

subtle to make a difference in real world bargaining. The effects of this distinction, however,

have been established not only in theory but also in experiments. Ken Binmore, Avner Shaked,

and John Sutton report the results of experiments run with students (with no prior exposure to

bargaining theory) at the London School of Economics.[14] These experiments did, in fact,

confirm that the outside option principle predicts the outcome of bargaining much better than

does the standard split-the-difference prediction generated by applying the Nash bargaining

solution to the bargaining game where the value of one party's outside option is treated as her

disagreement payoff.

This experimental support for the outside option principle also suggests that concerns for

fairness in bargaining, which also have experimental support, do not necessarily justify using the

Nash bargaining solution rather than the outside option principle. This is not surprising given

that, at least in bargaining situations where both parties stand to gain, the outside option principle

generally leads to a more equal division of the bargaining surplus than does the Nash bargaining

solution; under the Nash bargaining solution one party's outside option enables her to gain a

larger share of the surplus. Determining what parties might consider fair in bargaining situations

where one party necessarily receives a positive payoff and the other a negative one, such as

bargaining over a payment to waive specific performance, is more complex. I am not aware of

any experiments that test the role of concerns for fairness in this situation. In light of this, there

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[14] See *An Outside Option Experiment*, 104 Q. J. Econ 753 (1989).

is no strong reason to believe the Nash bargaining solution is a more plausible outcome for this reason. Furthermore, in some of the bargaining situations discussed in this article, such as bargaining about corporate takeovers or patent licensing, fairness is much less likely to play an important role than in bargaining in non-business contexts.

The next section explains in more detail why inside and outside options (or reversible and irreversible threats) have very different effects on bargaining outcomes. Section III uses the bargaining theory developed in Section II to analyze some of the main cases that Ayres and Madison use as examples in their paper. Section IV examines several other law and economics articles that use the Nash bargaining solution even though parties have outside, rather than inside, options. Section V considers how introducing uncertainty affects the bargaining outcome and illustrates its possible effects using the distinction between reversible and irreversible threats of inefficient performance. Section VI concludes.

II. Inside versus Outside Options in Bargaining Theory

It is well-known in the economics of bargaining literature that the Nash bargaining solution is an appropriate bargaining solution for bargaining games where the parties have inside options, but not for bargaining games where the parties have outside options.[15] The reason is that inside options affect the bargaining outcome by affecting one party's willingness to delay agreement. The larger a party's inside option, the higher her utility during bargaining, which reduces her urgency to make a deal. This gives her greater bargaining power. An outside option,

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[15] For a fuller treatment of the difference between outside options and inside options (or status quo payoffs) and a mathematical proof of the outside option principle, see John Sutton, 53 Rev. Econ. Stud. 709 (1986).

by contrast, only affects the bargaining outcome if it the party with such an option can credibly threaten to use it. So long as her bargaining partner is willing to offer her at least as much as she can obtain from exercising her outside option, the threat to exercise this option is not credible, so it will not affect the bargaining outcome.[16]

It should be noted that this result of the outside option principle holds under the assumption, which is standard in the economics of bargaining literature, that a party can only exercise her outside option after rejecting an offer. In particular, it is important that she cannot exercise her outside option after her offer is rejected.[17] As Avner Shaked has pointed out, this assumption reflects reality quite well in personal negotiations, particularly face to face ones, but may not be as accurate when negotiations take place over the telephone or computer.[18] The reason is that when negotiations occur over the phone or computer, a bargainer who does not hear her offer accepted can immediately trade with another without waiting to hear a counteroffer. When negotiations occur in person, on the other hand, a bargainer can always shout out one last offer as her negotiating partner is walking away.

This situation is likely to characterize the vast majority of legal bargaining situations even if negotiations do not always occur in person. The reason is that legal outside options usually cannot be taken immediately. Legal outside options are not like offers from someone on another phone line that can be accepted in an instant. If parties are engaged in settlement

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[16] A formal proof of this claim can be found in Sutton, *supra* note 15, or in Binmore, Shaked and Sutton, *supra* note 14, in the Appendix.

[17] For a discussion of what the bargaining equilibrium looks like when a party can exercise her outside option after her offer is rejected, see Avner Shaked, *Opting Out: Bazaars versus Hi-Tech Markets* 18 Investigaciones Economicas 421 (1994).

[18] *Id* at 421-422.

bargaining, the plaintiff cannot immediately force the court to issue a judgment after the defendant rejects her settlement offer. There is always time for the defendant to call the plaintiff back and make another offer. Similarly, a plaintiff cannot enforce specific performance instantaneously. She must go to court to get an order. During that process, the defendant can make a counter-offer. Thus, for the situations analyzed in this article, the standard assumption about when a party can exercise her outside option is very likely to accurately characterize the real-world bargaining environment.

Given this assumption, consider a bargaining situation like the one that Ayres and Madison consider. Say that there is potential defendant that owes some duty to a potential plaintiff. This duty will either be a continuous duty or a duty that can be discharged with some action or finite set of actions. I will assume this duty costs the defendant C to perform and benefits the plaintiff by an amount B. In the case where the duty is finite, C and B are the total costs and benefits from completing performance of the duty. In the case where the duty is continuous, C and B are the costs and benefits associated with the present value of the defendant's performance for the indefinite future. Furthermore, to focus only on the case where performance is inefficient, assume that $C>B$. Assume, for now, that C and B are common knowledge between the parties and that negotiation costs are trivial. So, because performance is inefficient, the parties will reach an agreement that excuses the defendant from performing. Lastly, assume that if the defendant does not perform her duty, the plaintiff has the option of choosing specific performance or monetary damages of D.

So far, this model is exactly like that of Ayres and Madison. This is the point, however, where Ayres and Madison assume that the negotiated amount that the defendant will pay the plaintiff is $N=\alpha C+(1-\alpha)B$. Since they do not distinguish between reversible and irreversible

threats (or between continuing and finite performance obligations), they assume this is the negotiated payment in both cases. They then describe α as a measure of the plaintiff's bargaining power and often assume in later examples that $\alpha=1/2$, as they do in the *Peevyhouse* example described above. I will refer to this N as N_{AM} (the Ayres and Madison negotiated payment).

If the defendant's performance obligation is continuing, then N_{AM} is a reasonable representation of the likely bargaining outcome. The reason is that the plaintiff can insist upon the defendant performing her obligation and then bargain with the defendant over an agreement to waive that obligation while the defendant is performing. By so doing, the plaintiff has actually shifted the status quo outcome (or disagreement point) to be the one where the defendant bears her cost of performance and the plaintiff obtains the benefit of that performance. That is, while they are bargaining, the defendant is losing (some fraction of) C in every stage of the negotiation while the plaintiff is gaining (some fraction of) B.[19] Thus, standard economic models of bargaining do, in fact, predict that the defendant would indeed agree to pay the plaintiff $\alpha C+(1-\alpha)B$ in exchange for being excused from having to continue to perform.[20] In this solution, α is primarily a function of the rate at which the bargainers discount the future. The more patient a player is, the stronger bargaining position she is in because she is more willing to delay an agreement in order to obtain a better deal. In the standard case where players are equally patient and the delay between when one party declines an offer and makes a counter

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[19] Clearly, the argument is identical in the case where it is the defendant that wants to threaten inefficient performance (say, because $D> N_{AM}$). In this case, the defendant's decision to perform shifts the status quo outcome and the plaintiff and defendant then bargain while each party is receiving her payoff from the defendant's performance.

[20] See Ariel Rubinstein, *supra* note 3 and Ken Binmore, Ariel Rubinstein, and Asher Wolinsky, *supra* note 3.

offer approaches zero, $\alpha=1/2$. This corresponds to the standard Nash bargaining solution that Ayres and Madison often use.

If the defendant's obligation is to perform a discrete activity, or series of activities with a definitive end, however, then the plaintiff cannot obtain her payoff from performance (and force the defendant to bear the cost of performance) while bargaining with the defendant over relieving her of that obligation. If performance is one discrete act, then once the plaintiff insists on performance, the defendant has already spent C, so she has no reason to further bargain with the plaintiff. This means that the plaintiff can only bargain with the defendant before she insists on performance. Because performance ends the bargaining in this case, performance is an outside option. Thus, under the outside option principle, the option of performing or forcing performance can not give one party a greater payoff than what she would get if she exercised this option. That is, the fact that an award of specific performance gives the plaintiff the option of forcing performance will not lead the defendant to ever offer more than B to be excused from performance.[21]

Ayres and Madison argue that the structure of civil litigation gives plaintiffs the ability to commit to requiring performance and that this commitment power enables it to hold up the defendant.[22] As they put it, "[t]here is almost always a period of time between the plaintiff's election of an injunctive remedy and the defendant's actual performance. Since the defendant will be willing to pay N once the plaintiff has sought an injunction, it becomes credible for the

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[21] Of course, if the defendant would have offered more than B even if the plaintiff did not have the right to order specific performance, then she will continue make this same offer (in excess of B). In this case, however, the option of specific performance has no effect on the bargaining outcome. Such a case might arise if the plaintiff had the right to sue for damages or specific performance and damages were in excess of B.

[22] See Ayres and Madison, *supra* note 4, at 67.

plaintiff to seek the injunction, even if B<D." The problem with this argument is that they assume the credibility of the plaintiff's threat to seek the injunction is independent of the settlement offer the defendant makes. It is indeed credible for the plaintiff to seek an injunction if defendant has not offered to pay to plaintiff at least *B*. But, once the defendant has offered *B*, the plaintiff does not want to enforce an injunction that eliminates the defendant's willingness to make this payment. This is where the issue of reversibility becomes important. If the injunction (or other order of performance) is reversible, the plaintiff does not eliminate the defendant's incentive to bargain by going forward with the order of performance. But, if the order is irreversible, the defendant's offer of at least *B* makes the plaintiff's threat no longer credible. Thus, the defendant need never offer more than *B* to prevent the plaintiff from inefficiently ordering irreversible performance.

Similarly, the fact that the defendant has the ability to perform at a cost of *C* rather than breach and pay damages of *D>C* (if, in fact, *D>C*) will never lead the plaintiff to accept less than *C* from the defendant in exchange for excusing performance. As long as the plaintiff has offered to accept *C* in exchange for waiving her right to sue for breach of contract, the defendant does not have a credible threat to reject this offer and perform. Once she performs, she has incurred the cost *C* and there is nothing more to bargain over. Performance is an outside option.

Performance remains an outside option even if it is a series of acts, as long as there is a definitive last act. To see this, consider the example Ayres and Madison use where the defendant's performance is divisible.[23] They imagine a situation where the total cost of performance to the defendant is 30 but is broken up into two stages, each costing 15. Furthermore, they assume that the plaintiff's benefit from performance is 8 and the expected

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[23] *Supra* note 4, at 62.

damages are 27. They argue that if the parties have equal bargaining power and can bargain

before each stage that the defendant can credibly threaten performance and thereby by able to

bargain to only have to pay the plaintiff 17.25 to be released from her duty.

This argument is based on the assumption that the results of the bargaining before each

stage are determined by the Nash bargaining solution. They say at if the defendant has

performed the first stage, then she has a credible threat to perform at the second stage (since the

cost of completing performance is 15 and the damages from not performing are 27). As a result,

they claim that in the second stage the parties would settle for 11.5 (the midpoint between the

plaintiff's benefit of 8 and the defendant's cost of 15). Notice, however, that with just one more

stage of performance left, performance is clearly an outside option. The plaintiff can offer to

settle for a payment from the defendant of 15 and sue if the defendant rejects this offer. The

defendant will never respond by performing since she could settle at the same cost. Given that

the court will award damages of 27 if the plaintiff sues, the defendant's best response is to accept

the plaintiff's offer. Given that the defendant will have to pay 15 in the second stage if she

performs in the first stage, she now has no incentive to spend 15 to perform in the first stage.

The general point is that any time performance is made up of a finite number of stages it

can only serve as an outside option. Performance in the last stage is clearly an outside option,

and, thus, one can use the outside option principle to determine the outcome of the bargaining

prior to the last stage of performance. Then, performance in the next to last stage puts the parties

in the position of the last stage, with an outcome that both can predict using the outside option

principle. Say, as in the above example, this outcome is that the defendant pays the plaintiff 15.

Then, if the defendant performs, she will bear a total cost equal to the cost of performance in the

second to last stage (call this k) plus the 15 she will have to pay to settle in the last stage. Thus,

she will not perform as long as the plaintiff agrees to accept no more than $15+k$. By working

backward, one can see that performance in each stage is an outside option whenever there are a

finite number of stages of potential performance.

The following tables summarize the difference in bargaining outcomes between

reversible and irreversible threats of inefficient performance. Table 1, which is (nearly) identical

Ayres and Madison's Table 1,[24] shows how much the plaintiff will receive from the defendant

when the threatened performance is reversible. Table 2 shows how this differs when the threat is

irreversible.

Damage Level	Whose Motive To Threaten	Is the Threat Credible?	Expected Payment Reversible Threat
1. $D<B<N_{AM}<C$	Plaintiff	Yes	N_{AM}
2. $B<D<N_{AM}<C$	Plaintiff	Yes	N_{AM}
3. $B<N_{AM}<D<C$	Defendant	Yes	N_{AM}
4. $B<N_{AM}<C<D$	Defendant	Yes	N_{AM}

Table 1: Reversible Threats in Four Potential Damage Ranges

When the threatened performance is reversible, Ayres and Madison's analysis is

appropriate. As they point out, in the first two cases the plaintiff can credibly threaten to require

the defendant to perform inefficiently simply to increase her compensation from the defendant's

breach of its obligation. Similarly, in the fourth case, the defendant may threaten to perform

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[24] Ayres and Madison, *supra* note 4, at 69.

inefficiently simply to pay (substantially) less than she would have to pay in damages or even less than it would cost her to actually perform.

The only difference between this table and Table 1 in the Ayres and Madison article is in case 3. Ayres and Madison argue that the defendant's threat to inefficiently perform is not credible in this case because it costs her more to perform than it does to pay damages. So, they claim that the defendant will simply pay D in damages to the plaintiff. If the defendant's threat is reversible, however, her threat may actually be credible. To see this, consider the following simple example where the defendant has promised to deliver coal to the plaintiff every month. Imagine that the cost of extracting coal from the defendant's mine has suddenly increased, so that it is no longer efficient for the plaintiff to buy coal from the defendant. In particular, imagine that the plaintiff receives a benefit (net of the contract price) from the coal delivery of 2 every month, but that it now costs the defendant 10 more than the contract price to deliver the coal every month. Furthermore, assume that both parties discount the future at the rate of 0.9 each month. That is, they each consider receiving a dollar next month equivalent to receiving 90 cents today.

In this example, the present value of performance to the plaintiff is $B=20$ while the present value of the cost of performing to the defendant is $C=100$.[25] Imagine that if the defendant breaches the contract, she will owe damages of $D=80$. According to Ayres and Madison's argument, the defendant's threat to perform is not credible because $C>D$. But, consider what happens if the defendant does continue to perform and simultaneously bargains

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[25] The present value of receiving a payment of 2 every month with a discount rate of 0.9 is

$2+2*0.9+2*(0.9)^2+2*(0.9)^3+\ldots$ This is equivalent to $2/(1-0.9)=20$. The present value of the cost to the defendant is calculated similarly.

with the plaintiff over a settlement to get out of the contract. While they are bargaining, the

plaintiff is obtaining a payoff of 2 per month and the defendant is paying 10 per month. Because

they earn these payoffs while bargaining, they represent disagreement points. The defendant

also has the option of stopping performance at anytime and then paying damages of 80. This

makes breach an outside option. According to the outside option principle, this outside option is

not binding since it gives the defendant a payoff that is less than what she could expect to get

from bargaining with the plaintiff if she did not have an outside option. That is, if the plaintiff

and the defendant split the difference between C and B, then the defendant would pay the

plaintiff 60. This gives the defendant a payoff of -60>-80, meaning that she has no reason to

ever exercise this option of breaching the contract. Because she has no reason to ever exercise

her outside option, the threat to do so is not credible. As a result, the outside option has no effect

on the bargaining outcome. This explains why the threat of reversible performance can be

credible even if the cost of that performance (if carried out forever) is greater than the damages

the defendant would owe for breach.

Thus, when the inefficient performance in question is reversible, the problem of threats of

inefficient performance may actually be more serious than Ayres and Madison's analysis

suggests. As the next table shows, however, the situation is very different when the inefficient

performance is irreversible.

Damage Level	Whose Motive To Threaten	Is the Threat Credible?	Exp. Payment Irreversible Threat
1. $D<B<N_{AM}<C$	Plaintiff	Yes	B

2. $B<D<N_{AM}<C$	Plaintiff	No	D
3. $B<N_{AM}<D<C$	Defendant	No	D
4. $B<N_{AM}<C<D$	Defendant	Yes	C

Table 2: Irreversible Threats in Four Potential Damage Ranges

Notice that in case 2, if the plaintiff is threatening to require the defendant to perform an irreversible obligation, then her threat is no longer credible. The reason is that were she to do so, the defendant would only have to offer her B to deter her from actually carrying out this threat. Because $B<D$, the plaintiff simply prefers to sue for damages. Also, notice that when the threat is irreversible, the expected payment is never given by the Nash bargaining solution. If the threat is not credible, the payment is simply the damages the court will award for non-performance. If the threat is credible, then it is only because damages are either clearly insufficient (they are less than both the plaintiff's benefit and the defendant's cost of performance) or clearly excessive (they are greater than both the plaintiff's benefit and the defendant's cost of performance). In these cases, the threat of inefficient performance simply serves to bring the damage measure in line with either the lower or upper bound of what is appropriate. That is, it serves the function of correcting for a likely court error, but it does not allow one side to hold up the other.[26]

To recap the main result of this section, the economics of bargaining imply that all types of threats of inefficient performance are not identical. If a threat is completely reversible, in that one party can carry out the threat and still negotiate to eliminate all future losses from inefficient performance, then the Ayres and Madison analysis is correct. Such threats can allow one party

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[26] This is precisely the standard rationale for granting an injunction. For example, in Miller v. LeSea Broad., Inc., 87 F. 3d 224, 230 (7th Cir. 1996) the court suggested that damages could be "an inadequate remedy…because of the defendant's lack of solvency or because of the difficulty of quantifying the injury to the victim of the breach."

to obtain a payoff in excess of what she could receive if she carried out the threat. On the other hand, if the threat is not reversible, then the Ayres and Madison analysis is incorrect. Such threats are like outside options in that once one party carries out the threat there is nothing to bargain over. In these cases, while the ability to threaten inefficient performance does give that party the ability to obtain the same payoff it would obtain if it carried out its threat of inefficient performance, it cannot bargain for any greater payoff.

III. Applications of the Theory to Threats of Inefficient Performance

The outside option principle suggests that in many cases (but, by no means all) the concerns that Ayres and Madison have regarding threats of inefficient performance are not likely to be problematic. For example, Ayres and Madison are concerned that cost of performance damages may not serve their intended function of giving the plaintiff all the gains from efficient breach.[27] They argue that because the defendant can threaten to perform, even when such performance is inefficient, she will in fact pay substantially less to the plaintiff than what it would cost her to perform. The above analysis demonstrates that this is only a concern in cases where the defendant's obligation is ongoing. For example, in the coal case discussed in the introduction, the coal company had an ongoing obligation to supply coal to the buyer. If continued production of coal had become uneconomical, but the coal company had expected damages to be in excess of its losses from continuing to supply the buyer, it could have threatened continued inefficient performance to extract a more favorable settlement from the buyer. Because it could continue to perform its obligations under the contract while bargaining

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[27] *Supra* note 4, at 62.

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with the buyer to negotiate a waiver of those obligations, the Nash bargaining solution provides a reasonable prediction of the likely bargaining outcome. It is in situations like this where Ayres and Madison are correct that the ability to threaten inefficient performance can prevent cost of performance damages from giving the plaintiff all the benefits of efficient breach.

When the defendant's obligation is to perform one task or a finite series of tasks, however, then there is no reason to worry that threats of inefficient performance will undermine the ability of cost of performance damages from giving all the benefits of efficient breach to the plaintiff. For example, imagine that in *Peevyhouse* the court would have awarded cost of performance damages. Since the defendant's obligation was a discrete task, to return the plaintiff's topsoil, the defendant could not use a threat of inefficiently returning this topsoil in order to induce the plaintiff to accept less than the (say) $30,000 it would cost the defendant to perform its contractual obligations. As long as the plaintiff replies to any defendant offer by counter-offering to accept $30,000 to waive the defendant's obligation to perform, the defendant has no incentive to perform rather than accept the settlement. And since the defendant's obligation is irreversible, once it has returned the topsoil, it is not in a stronger bargaining position since there is nothing left to bargain over at that point. In situations like this one, threats of inefficient performance do not undermine the law's ability to determine how to allocate the benefits of efficient breach.

Ayres and Madison are even more concerned that plaintiff threats of seeking injunctive orders of inefficient performance will cause damages to exceed make whole compensation. Once again, this concern is only well-founded in cases where the equitable relief the plaintiff seeks is reversible. In many of the cases that Ayres and Madison use as examples, the inefficient performance the plaintiff seeks is largely reversible, suggesting that these threats may often be

sought merely for bargaining leverage. The coal case discussed above where Judge Posner

denied the coal seller the order of specific performance is one such example. Other examples

include *Edwards v. Allouez Mining Co.*[28] and *Rievman v. Burlington Northern Railroad Co.*[29]

In *Edwards*, the defendant's stamp mill deposited large quantities of sand on the bottom

lands below a creek. A year after the defendant erected the mill, the plaintiff bought land on the

creek just below the mill. "The land was not purchased for use or occupation, but as a matter of

speculation, and apparently under the expectation of being able to force defendant to buy it at a

large advance on the purchase price. It was offered to defendant soon after the purchase, and

though no price was named, the valuation which has been put upon it by complainant and by

witnesses is from three to five times what it cost him, and this perhaps gives some indication

what his expectations were."[30]

In the context of our bargaining theory, these expectations make sense provided the

plaintiff thought the injunction we was seeking would only temporarily shut down the stamp

mill. Assuming that operation of the stamp mill is efficient, by obtaining the injunction the

plaintiff can force the defendant to suffer the loss of suspended operations of its mill while they

bargain over the price of the plaintiff's land. If the mill can be profitably restarted once the

bargain is completed, then the injunction does, in fact, give the plaintiff substantial bargaining

leverage to extract a much greater payment than the loss he suffers due to the mill's operation.

Notice, however, that if the injunction were to cause the mill to close forever (maybe because it

would lose its customers as a result of closing), then the threat of the injunction would only be an

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[28] 38 Mich. 46 (1878).

[29] 118 F.R.D. 29 (S.D.N.Y. 1987).

[30] *Edwards*, 38 Mich. at 48.

outside option and the plaintiff could not use the threat of the injunction to extract a greater payment than the loss the mill's operation caused him. So, an important inquiry in cases like this is whether the plaintiff is seeking injunctive relief that is necessarily permanent or whether it is relief that can be reversed if the two parties agree to do so. If the injunction is irreversible, then it is much more likely that the plaintiff is seeking this relief because she believes damages will under-compensate her.

In *Rievman*, the plaintiffs also sought specific performance that was reversible. In this case, bonds were issued in 1896 that were secured by realty. The terms of the bonds made sale of the realty extremely difficult. By 1985, the realty was worth billions more than the outstanding principal of the bonds, so the defendant sought to substitute other collateral. The plaintiff bond holders sued to enjoin the defendant from doing so. The threat of this injunction forced the defendant to pay $35.5 million to the plaintiffs in addition to providing substitute collateral. According to our bargaining theory, a key reason the plaintiff was able to extract such a large payment from the defendant is that the injunction was reversible. The fact that the plaintiff was able to prevent the defendant from using substitute collateral on its own did not prevent the defendant from later using substitute collateral after agreeing to pay the plaintiff for this right. Thus, it is not surprising that this is a case where the plaintiff was able to extract a payment that far exceeded its loss from defendant's use of alternate collateral.

Not all forms of equitable relief, however, are as easily reversible as those in *Edwards* and *Rievman*. In *Peevyhouse*, for example, performance is clearly irreversible since once the defendant has returned the topsoil to the plaintiff's land, its obligation is completely discharged. Another case that Ayres and Madison use to motivate their theory is the classic case of *Pile v.*

Pedrick.[31] In this case, Pedrick built a factory whose foundation extended onto Pile's land by 1

and 3/8 inches. The court offered Pile a choice of damages or a court order to remove the

trespassing wall. Ayres and Madison argue that Pile chose the latter solely for the strategic

reason of extracting a larger payment from Pedrick than he could have received as damages.

But, in this case, Pile's option of forcing Pedrick to remove the wall is clearly an outside option.

Once Pedrick removes the wall, he has no reason to pay Pile anything. So, if Pile's actual

benefit from Pedrick's performance (removing the wall) was zero, as Ayres and Madison

suppose, he would never force Pedrick to perform as long as Pedrick was offering him any

positive amount for the right to leave the wall standing. While the Nash bargaining solution may

predict that Pedrick will have to make a much larger payment, it is not appropriate to use the

Nash bargaining solution in cases like this. As a result, either Pile misjudged the bargaining

leverage a court order would give him or he suspected the court would award damages that

would not fully compensate him for his loss.

Of course, the threat in *Pile* need not be a completely irreversible threat. Imagine that,

even before the factory is built, it is efficient for Pedrick to build his factory wall so that it does

extent slightly onto Pile's land. In the original case, one assumes that it is efficient for the wall

to remain in place because it has already been constructed and tearing it down and rebuilding it

would be very costly. For this example, however, we need to further assume that the

encroachment is efficient even before the expense of building the wall has been sunk. To be

concrete, say that Pedrick's benefit from building the wall so that it extends slightly onto Pile's

land is $1,000 and imagine that doing so reduces Pile's value from his land by $400. If Pile

obtains an injunction that prevents Pedrick from encroaching on his land, then enforcing

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[31] 31 A. 646 (Pa. 1895).

Pedrick's compliance with this injunction becomes a reversible threat. If the wall has not yet

been built, Pile can enforce the injunction while bargaining with Pedrick over a price for waiving

the injunction. Thus, if Pile receives the injunction before the wall is built, the threat of

enforcing the injunction becomes an inside option, rather than an outside option. As a result, the

Nash bargaining solution becomes appropriate, and one can expect Pedrick to have to pay Pile

$700 for the right to build on Pile's land.[32]

Now consider the actual case where Pedrick has already built the wall before Pile sues

him and assume it would cost Pedrick $10,000 to tear down the wall and rebuild it. If Pile sues

for the right to force Pedrick to remove the wall so that it does not extend onto Pile's property,

Pile now has (from the perspective of bargaining theory) two distinct rights. The first is the right

to force Pedrick to spend $10,000 to tear down the wall and rebuild it. The second is the right to

prevent Pedrick from building on his land, a right that costs Pedrick $1,000. The threat of

enforcing the first right is irreversible (once the wall is torn down and must be rebuilt, it is

impossible to save the $10,000 again). So, it gives Pile an outside option. But, the threat of

enforcing the second right is reversible, giving Pile an inside option. Once Pedrick has torn

down the wall, Pile can still agree to sell Pedrick the right to build on Pile's land. That is, if Pile

enforces the first right, we can expect that he and Pedrick will negotiate a settlement whereby

Pedrick pays Pile $700 for the right to build on the land. This makes Pile's benefit from

exercising his outside option of forcing Pedrick to tear down the wall $700 rather than $400.

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[32] Allowing Pedrick to build on Pile's land creates a surplus of $600 ($1,000-$400). If the parties split the surplus

equally, then the plaintiff must obtain his benefit from having the use of this small portion of his land ($400) plus his

share of the surplus ($300). So, the Pedrick must pay Pile $700.

Imagine that a court offers Pile the choice of receiving damages of $500 or the right to have the wall removed. Even though the damages exceed Pile's value from having the use of that small piece of his land, Pile will still choose the right to have the wall removed. The reason is that Pedrick will have to offer Pile $700 to ensure that Pile does not enforce his right to have the wall removed. Pile cannot threaten inefficient performance to hold up Pedrick due to the cost of tearing down and rebuilding the wall, but he can hold him up for a share of the smaller benefit from letting Pedrick use some of his land. The expected payment does exceed Pile's loss and the damages a court would award, but that does not make it necessarily inequitable. In fact, this is exactly the same amount that Pedrick would have expected to have to pay Pile if he had sought to buy this small piece of land from him in the first place. Contrary to what Ayres and Madison claim,[33] by allowing Pile the right to force removal of the wall, all the court is doing is creating an environment that produces the same outcome that would have occurred had the parties pursued voluntary exchange in the first place.

IV.   Other Examples of The Misuse of the Nash Bargaining Solution

The Ayres and Madison article is far from the only example where scholars have failed to distinguish between outside options and inside options when using bargaining models in economic analysis of law. Another recent example of an article uses the split the difference (or Nash) bargaining solution rather than recognizing the importance of the outside option principle

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[33] S*upra* note 4, at 86 note 78 (arguing that the bargain may be drastically different after the wall is built than it would have been before it was built). This conclusion is based on the Nash bargaining solution, which is not applicable for the cost of removing and rebuilding the wall, since forcing Pedrick to do that is an outside option.

is *Playing Favorites with Shareholders* by Stephen Choi and Eric Talley.[34] While this article

makes many worthwhile contributions, it also includes a model of bargaining between the

existing management of a company and a large bloc shareholder that treats an outside option like

an inside option. They use this model to argue that allowing the existing management to make a

side payment to the bloc shareholder to refrain from a takeover can force management to commit

to appropriating a smaller level of private benefits of control.[35] They use the following example

to illustrate their point. In this example, they show (the details are not relevant here) that if the

incumbent management limits its ability to expropriate the firm's assets to 3.67 percent that the

net cost of a takeover and the net benefit are equal, both are $22.94 million. But, if the potential

acquirer purchases one share of the company before attempting to take over the company, it has

lowered its costs of acquiring control to slightly less than $22.94 million ($4.59 in this example).

This gives the potential acquirer a credible threat to take over the company if the existing

management does nothing. As a result, Choi and Talley argue that the potential acquirer can

extract a significant portion of the existing management's private benefits of control in exchange

for an agreement not to initiate a takeover. In particular, they assume an equal bargaining split

(the potential acquirer can obtain half of these benefits).[36] In order to deter the potential acquirer

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[34] 75 S. Cal. L. Rev. 271 (2002).

[35] *Id* at 334-340.

[36] In the more technical version of their article, *A Defense of Shareholder Favortism*, ?? at 10, they explicitly

acknowledge that their argument depends on the assumption that the potential acquirer will receive a large enough

share of the surplus from reaching an agreement. Under the outside option principle, their Corollary 2.1

demonstrates that aggregate firm value is identical whether shareholder favoritism is permitted or not (since the

outside option principle is equivalent to the generalized Nash bargaining solution in their article where the

management has all the bargainining power), *Id.* at 37.

from acquiring a toe-hold bloc of shares that gives it a credible threat of appropriating half of the existing management's private benefits of control, they show that the existing management must limit its ability to appropriate the firm's assets to a much lower level than if bargaining were not possible (2.12 percent instead of 3.67 percent). This is one of their arguments for why it might be a good idea to allow management to favor some shareholders: it gives them better incentives to limit their ability to expropriate firm value.

A key step in this argument is the claim that once the potential acquirer has a credible threat to take over the firm, if the existing management does nothing, the potential acquirer can extract a significant portion of the private benefits of control through bargaining with existing management. Notice that this argument is exactly like the argument Ayres and Madison use to explain why specific performance can lead to over-compensation in *Peevyhouse*. As a result, the same rejoinder applies. The threat to take over the company is an outside option. Once the potential acquirer has executed a takeover, there is nothing left to bargain over. Thus, the value of the takeover threat operates only as a constraint upon the bargaining outcome; it does not shift the disagreement points with respect to the split of the surplus from agreement. As a result, the fact that the cost of acquiring a toehold bloc of shares is sunk does not give the potential acquirer the leverage that Choi and Talley claim it does.

To see this, consider the simple case where the incumbent management maintains the 3.67 percent limit on its ability to appropriate firm value and the potential acquirer buys one share for $96.33 (the share price when management limits its ability to extract private benefits to 3.67 percent). If purchasing this share reduces the cost of the acquisition to $4.59 less than the benefits, then the takeover threat is credible only if management makes an offer to share less than $4.59 of its private benefits of control with the acquirer. If it offers the potential acquirer

$4.60, it is not credible that the acquirer would reject this offer and execute the takeover that would yield her a smaller net payoff. This is the outside option principle. Because of this, it does not pay for the potential acquirer to spend $96.33 to acquire an outside option that will only yield it a payoff of $4.60. The same argument can be used to show that there is no toehold bloc that will give the potential acquirer a positive net payoff if the incumbent management limits its ability to appropriate firm value to 3.67 percent. That is, because of the outside option principle, the ability to bargain with some shareholders to prevent a takeover has no effect on existing management's incentives to limit its ability to appropriate firm value.

A recent article by Oren Bar-Gill and Gideon Parchomosvky[37] helps illustrate some of the subtleties involved in determining whether an alternative option is an inside or outside option—or some combination of both. This article considered an inventor's incentive to choose between obtaining a broad patent or a narrower patent while also revealing more information about its invention. Bar-Gill and Parchomovsky argue that an inventor who expects that follow on inventions will greatly increase the value of her invention might prefer to publish her innovation and obtain a narrower patent. Their argument is that the narrower patent prevents the original inventor from holding up the subsequent inventor, thus encouraging subsequent innovation.

The argument can be seen most easily by use of their binary example.[38] In this example, the original inventor can choose between obtaining a broad patent that, by itself, gives the inventor a payoff of 400. Alternatively, she can obtain a narrow patent that gives her a payoff of 200. There is a subsequent inventor who can produce a follow-on invention that, when

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[37] *The Value of Giving Away Secrets*, 89 Va. L. Rev. 1857 (2003).

[38] Id. At 1874. The analysis of the bargaining problem in their more general formulation is qualitatively similar.

combined with the original invention produces a payoff of 1,000. If the subsequent inventor cannot use the original invention, then this invention is worthless. The cost of developing this invention is 350. If the original inventor chooses a broad patent, then when it is bargaining with the subsequent inventor over a license for the original invention, the bargaining range for a payment for the license will be between 400 and 1,000. Bar-Gill and Parchomovsky argue that, if the parties have equal bargaining power, then the original inventor will obtain 700 for the license (splitting the difference between 400 and 1,000), leaving the subsequent inventor with only 300. The subsequent inventor, anticipating this outcome, would then not want to spend 350 to develop this subsequent invention since she cannot recoup her costs. As a result, the original inventor is bettor off, they argue, choosing a narrow patent that leads to a license fee of 600 (splitting the difference between 200 and 1,000) so that the subsequent inventor has an incentive to develop the follow-on invention.

This is the correct analysis of the bargaining game if the original inventor's stand-alone payoff from its patent is an inside option. Is the stand-alone payoff an inside or outside option? It turns out that it could be either, or something in between, depending on the fixed cost of producing and marketing the product that uses only the original invention. To see this, notice that to determine whether the payoff from the original invention is an inside or outside option, one has to know whether the original inventor will earn this payoff while it is bargaining with the follow-on inventor over the license fee. Of course, the stand-alone payoff is not exactly like an outside option since the original inventor can continue to bargain with the follow-on inventor even after the original inventor markets her product. It is not exactly an inside option unless there are no fixed costs to bring the product to market or the fixed costs have been already sunk before the bargaining over the license commences. Otherwise, it turns out that if the cost of

bringing this product to market is less than half as big as the gross benefit from doing so, the threat to sell this product during the bargaining process will be credible.[39] When the fixed costs are larger, this threat will not be credible, making it operate as an outside option. In this case, since the original inventor will only receive a license fee equal to the value of her outside option, she has no incentive (even ex ante) to limit the scope of her patent to reduce this value.

If the fixed costs are less than half the gross benefit (which is probably the usual case), then Bar-Gill and Parchomovsky's theory explaining the advantage of limited patents is applicable, though the degree to which an inventor might want to limit her patent does change somewhat. This follows because the net benefit is still not exactly like an inside option unless the original inventor actually decides to bring it to market (which she might do if the follow-on invention will not be marketable for some time). If the follow-on product can be produced and sold soon after the original one, however, the original inventor might prefer not to spend the fixed costs to market the original invention by itself, even though the threat to do so would be credible. In this case, her payoff from the inside option bargaining game operates as an outside option payoff. To see this, consider the following slight modification of the Bar-Gill and Parchomovsky example. Say the stand-alone payoff for the original invention is 400 because to bring the product to market involves sunk costs of 100 but yields a future stream of profits with a

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[39] By marketing the product, the original inventor makes the option an inside option. If the gross, stand-alone, payoff from the original invention is G and the total payoff from using both inventions is T, then the original inventor will receive a payoff of $(G+T)/2$ from bargaining with an inside option of G. To obtain this payoff, she must spend F, the fixed costs of bringing the original product to market. If she does not spend F, and $G-F<T/2$, then her stand-alone payoff is a non-binding outside option, so she will receive T/2 from the license agreement. So, if $(G+T)/2-F>T/2$, or $F<G/2$, then her threat to bring the original product to market is credible. I thank Oren Bar-Gill and Gideon Parchomovsky for pointing this out.

present value of 500. The original inventor now has a credible threat to actually market her

product by itself which would give her an inside option of 500 and a license fee of 750 (the mid-

point between 500 and 1000). Because she has to spend 100 to get this inside option, however,

before she has done so this is like an outside option of 650. That is, if the follow-on inventor

offers her 650, she will accept rather than spend 100 to bring the product to market. This leaves

the follow-on inventor with a payoff of 350, exactly the cost of developing the product.

What this example indicates is that while (when fixed costs are not sunk) carefully

modeling the bargaining process would not change the qualitative nature of the Bar-Gill and

Parchomovsky results, it would allow readers to more accurately assess the range of situations

for which their theory can explain limited patents. In th previous   example, the patent must

produce a stand-alone payoff greater than 400 (as opposed to 350) to deter the follow-on

invention.[40] Thus, the optimal patent breadth is now larger, but the qualitative incentive of the

original inventor to limit patent breadth remains. More importantly, a more detailed model of

the bargaining process demonstrates the importance of an additional factor in their analysis, the

size of the fixed costs in marketing the original invention.

Another example that demonstrates the importance of one's choice of bargaining model

can be found by looking at Lucian Bebchuk's article on settlement bargaining for negative

expected value suits.[41] This article does not misuse the Nash bargaining solution, but it does set

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[40] The general formula for determining the maximum net stand-alone value of the original invention can be

determined as follows. The net payoff from making selling the original product an inside option is (G+T)/2-F, as

the prior footnote explains. Thus, the payoff left for the follow-on inventor is T-((G+T)/2-F)=(T-(G-F))/2+F/2.

Since G-F is the net payoff, let's call this N, this can be written as (T-N+F)/2. If K is the cost of developing the

follow-on invention, then the follow-on inventor will invent it if and only if (T-N+F)/2>K or N<T+F-2K.

[41] *A New Theory Concerning the Credibility and Success of Threats to Sue*, 25 J. Legal Stud. 1 (1996).

up a bargaining model that generates a similar result, thus bypassing the outside option principle

that applies to alternating offer games. His model can be briefly described as follows. A

plaintiff brings a suit that that will cost the plaintiff more to litigate than she expects to receive

from the judgment. However, the litigation costs are incurred in several stages, and the parties

can bargain between each stage. After some number of stages, the plaintiff's remaining legal

costs are less than the expected judgment, making her threat to continue the suit credible at this

stage (and all subsequent stages). Bebchuk's model shows that, because of the ability to incur

litigation costs over time, a plaintiff can credibly extract a settlement offer from the defendant

even if the suit is a negative expected value suit.

There is nothing wrong with the analysis that flows from Bebchuk's model, but the way

he models the bargaining process is critical to the result he obtains. Bebchuk assumes that in

between each stage, one party, either the plaintiff or the defendant, can make a take it or leave it

settlement offer to the other. If this offer is rejected, the case continues to the next stage. If it is

accepted, the case settles. He assumes that in every period there is an equal probability that the

plaintiff or the defendant will get to make this offer. To see how this model works, it suffices to

consider a simple two stage example, very similar to the example that Bebchuk uses.[42] The

plaintiff and defendant both agree that the expected judgment from the case, should it proceed to

trial, is 100. Both the plaintiff and the defendant must spend 140 in total to litigate the case, 70

in each of two periods. If the case proceeds into the second period, the plaintiff will spend 70 to

litigate since by so doing, she can expect to win 100, costing the defendant a total of 170. So, if

the plaintiff gets to make the settlement offer prior to the second period, she can offer 170 and

the defendant will accept. If the defendant makes the offer, he can offer 30 and the plaintiff will

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[42] *Id.* at 6-7.

accept. Since each side is equally likely to make the offer, the average payoff for the plaintiff at this stage is 100.

Now consider the first period. If the case does not settle prior to the first period, the plaintiff will spend 70 since by so doing she can expect to get an average settlement of 100 prior to period 2. Thus, the defendant will be willing to accept a settlement offer by the plaintiff of 170 (since this saves him the 70 he must spend in period 1 and the 100 he expects to pay on the average prior to period 2 to settle the case then). The plaintiff will accept a settlement offer of 30 since otherwise she would have to spend 70 to obtain a settlement of 100 (on the average) next period. Thus, the plaintiff's average payoff from this suit is 100, the average of 30 and 170.

Notice, however, that in each period only one side can make an offer before more litigation costs must be incurred. In particular, the plaintiff has a 50 percent chance of being able to make a take it or leave it offer. This eliminates the mechanism that generates the outside option principle. Imagine, instead, that between every period of litigation expenses, the parties engaged in an alternating offer bargaining game that did not end until either they agreed or one side decided to leave the bargaining table to start the next stage of litigation expenses. Now the bargaining process is one where the outside option principle does apply. As long as the defendant can always shout out a last offer as the plaintiff leaves the table, the plaintiff cannot expect a positive payoff from a negative expected value suit. To see why, consider the second stage. The defendant can respond to any plaintiff offer with a counter-offer of 30. By so doing, the plaintiff's threat to walk away and litigate the case is not credible (she will only earn a net payoff of 30 by litigating). Thus, the outside option principle implies that the best the plaintiff can do is to accept the defendant's offer of 30 immediately. But, once the plaintiff can get a settlement that is no better than 30 in the last stage (rather than an average of 30 and 170, as in

the Bebchuk model), she does not have a credible threat to spend the 70 in the first stage. The defendant can refuse to pay her any settlement in the first stage, and she will prefer to drop the case rather than spend 70 to obtain a settlement of 30 before the final stage. Adding more stages does not change the result because in every stage the plaintiff receives no more than the payoff she would get from proceeding to the next stage. Since her payoff from proceeding through all the stages from the beginning is negative (it is a negative expected value suit), she does not have a credible threat to proceed past the first stage.

One might object that this bargaining formulation effectively gives the defendant all the bargaining power since he always gets to make the last offer. But, in fact, there is no necessarily last offer. Rather, the driving assumption is that the plaintiff can only exercise her outside option of proceeding to the next stage of litigation after rejecting an offer, rather than after having her offer rejected. This is exactly the assumption that Shaked argues is appropriate for negotiations such as this.[43] The option to litigate is not an option that can be exercised instantaneously. Even if settlement negotiations occur over the phone, the defendant's attorney can always call back after the plaintiff's attorney hangs up the phone but before she has done any significant additional trial preparation. This does not necessarily give the defendant the last offer; it just gives him the ability to continue the negotiations. As long as one believes the defendant has this ability, the plaintiff should not be able to use a negative expected value suit to extract a positive settlement offer from the defendant.

The issue of how to treat outside options in bargaining models extends even to articles about family law. Consider Amy Wax's recent article *Bargaining in the Shadow of the Market:*

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[43] *Supra* note 15, at 421-422.

Is There a Future for Egalitarian Marriage.[44] In this paper she defines an egalitarian marriage

as one where the gains from the marriage are shared equally between the two spouses. She

distinguishes between two types of marriages, never egalitarian marriages and potentially

egalitarian marriages.[45] Never egalitarian marriages are those where one spouse has an outside

option (his or her utility from a divorce) that exceeds half of the joint gains from the marriage.

She correctly argues that in such a marriage, an equal split is impossible since once spouse could

do better by getting a divorce. In potentially egalitarian marriages, on the other hand, neither

spouse has an outside option that exceeds half the joint gains from the marriage. Thus, if the

joint surplus from the marriage were split equally, neither spouse could do better by obtaining a

divorce.

When Wax discusses the question of whether potentially egalitarian marriages will

actually end up as egalitarian marriages, she notes that:

> While there is no *a priori* reason to believe that real-life bargaining will result in
> the parties' adopting the Nash solution--an equal split of the bargaining surplus—
> that solution can be used as the starting point for gauging the influence of factors
> that might give the parties an advantage in real-world barg ining. It is not
> implausible to assume that an equal split of the bargaining surplus should result if
> the parties possess perfect information and if all the factors that might affect the
> conduct of the bargaining are in balance as between them. In this sanitized setup,
> the allocation of the cooperative surplus will be a straightforward reflection of the
> relative strength of the parties' threat advantages. Put another way, starting from
> the theoretical position of an equal division of the bargaining surplus in a typical
> split-the-pie game, the ability of one party to persuade the other to deviate from
> that position is likely to reflect some bargaining advantage other than that
> conferred simply by the lower limit on what each bargainer will rationally
> accept.[46]

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[44] 84 U. Va. L. Rev. 509 (1998).

[45] *Id*. at 563-564.

[46] *Id*. at 576-577.

While I certainly agree that one must consider factors that may make real-world bargaining outcomes diverge from what economic models may predict, it is important to use the correct theoretical benchmark solution. When the bargaining is over the gains from a marriage and the alternatives are the spouses' utilities outside of the marriage, these alternatives clearly represent outside options, not inside options. So, the Nash solution is clearly not appropriate for analyzing the division of the surplus in marital bargaining.

Using the outside option principal to analyze marital bargaining gives reason for much greater optimism regarding the possibility of egalitarian marriage. While, as Wax points out, under the Nash bargaining solution there will never be an egalitarian marriage unless the two spouses have identical outside options,[47] the result is very different under the outside option principal. As long as neither spouse has a binding outside option (neither spouse's utility outside of the marriage is greater than half of the joint utility from the marriage), every marriage will have an egalitarian division of payoffs. The fact that the husband's utility outside of marriage might be greater than the wife's does is irrelevant to the bargaining outcome if neither has a credible threat to end the marriage. As long as both spouses' divorce utility is less than half the marriage utility, neither can credibly threaten divorce when offered an equal split of the marital utility. So, under the outside option principle, any potentially egalitarian marriage will be an actually egalitarian marriage. Granted, this only holds if other factors that affect bargaining power, such as both parties willingness to delay reaching an amicable agreement, are equal. As Wax argues, there are reasons to believe that these other factors may often be far from equal.[48] Nonetheless, it is quite important to take this observation from the correct starting point, which

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[47] *Id*. at 577.

[48] *Id*. at 579-580.

can only be done by recognizing that it is the outside option principle, and not the Nash bargaining solution, that provides the correct theoretical benchmark prediction of the bargaining outcome in this setting.

In the interest of full disclosure, I must admit that I also misused the Nash bargaining solution in a prior article. In *Damages for Breach of Contract: Should the Government Get Special Treatment?*,[49] I consider the problem faced by a newly elected government that is bound by a contract for a public works project that was signed by the prior government that valued that project much more. Because the new government does not value the project as much, it wants to renegotiate the contract with the contractor to shrink the size of the project. In my model of the renegotiation between a contractor and a newly elected government, I assumed that the price of the renegotiated contract would be given by the Nash bargaining solution where I treated the new government's payoff from breach of the original contract as an inside option, rather than as an outside option, as it clearly is.

Using the outside option principle, rather than the Nash bargaining solution, changes one of the two main results of the paper: the initial project size chosen by the first government when damages for breach of contract are independent of project size will always be larger than the socially optimal level, rather than only being larger under certain conditions. The second main result, that both expectation damages and reliance damages lead to even larger initial projects than when damages are independent of project size, is not affect by the use of the outside option principle rather than the Nash bargaining solution.

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[49] 17 J. Law Econ. & Org. 121 (2001).

The use of the Nash bargaining solution rather than the outside option principle even extends to a leading law and economics textbook, *Law & Economics*[50] by Robert Cooter and Thomas Ulen. This book only discusses the effect of outside options in bargaining in the answer to a question and then suggests that splitting the surplus is the most reasonable solution. The example they discuss has Adam selling a car to Blair that Adam values at $3,000 and Blair values at $4,000. They suggest that splitting the difference represents a reasonable sales price. Then they ask what a reasonable price would be if Adam receives a bid of $3,200 from Clair.[51] In their discussion of the answer to this question, Cooter and Ulen argue that since Adam's threat value is now $3,200 a reasonable price is one that splits the difference between $3,200 and $4,000; a price of $3,600.[52] Of course, once Adam sells the car to Clair, he cannot still bargain with Blair. Hence, the option to sell to Clair is an outside option. The option is non-binding since it is less than $3,500. Under the outside option principle, this offer from Clair has no effect on the bargaining outcome.

V.   Some Effects of Uncertainty

Prior to this point, I have assumed (as have all the articles I've discussed) that there was no uncertainty. In the context of the Ayres and Madison article, this means that both parties knew both exactly how much performance would cost one side and benefit the other. Moreover, it also means that both parties also know (and agree) whether a threat is reversible or irreversible.

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[50] 3rd Edition (2000).

[51] *Id*. at 75-77.

[52] *Id.* at 496-497.

In this section, I will discuss the implications of relaxing these assumptions in the context of inefficient performance threats. This analysis demonstrates that introducing uncertainty does not resurrect results based on the Nash bargaining solution for threats of inefficient performance. A full analysis of the effects of introducing uncertainty in the articles discussed in the last section is beyond the scope of this article. But, this discussion should make it clear that introducing uncertainty will not necessarily justify using the Nash bargaining solution.

First, consider the case of uncertainty about whether a threat to enforce performance is irreversible. The *Edwards* case provides a good illustration of the issues that this may present. Recall that in this case, the plaintiff sought an injunction to block the operation of a stamp mill that was dumping sand on his land. In a case like this, it would be surprising if the plaintiff knew for sure whether or not the defendant's mill operation would survive the issuance of an injunction. It maybe that the mill's customers would begin to use another mill if there was an injunction against this mill's operation and that they might not return even after the injunction is lifted. On the other hand, it is also possible that the mill would continue to be as profitable as ever after the injunction was lifted. The owner of the stamp mill presumably has a good idea of which scenario is more likely. The plaintiff, on the other hand, is much less likely to know whether the mill can survive the injunction. In bargaining terminology, this means that while the defendant may know whether or not the plaintiff's threat represents an outside option or an inside option, the plaintiff does not know which type of option he has.

To see what effect this has on the likely bargaining outcome, imagine that the operation of the stamp mill provides a benefit that has a present value to the defendant of 100, and that continued operation of the mill reduces the present value of the plaintiff's land by 20. If both the plaintiff and the defendant know that the mill can survive an injunction, then giving the plaintiff

the right to close down the mill gives him a reversible threat. As a result, we expect that the defendant would have to pay the plaintiff 60 for the right to continue operating the mill.[53] On the other hand, if both sides know that the mill cannot survive an injunction, then the threat of injunction represents an outside option; the defendant will only have to pay the plaintiff 20. Now, say the plaintiff does not know for sure whether the mill can survive an injunction, but he thinks there is a 40 percent chance that it can. In this case, the value to the plaintiff of obtaining the injunction is $(0.6)*20+(0.4)*60=36$. If the injunction causes the mill to close, the plaintiff's land is worth 20 more to him. If the mill does not close, then the plaintiff can bargain with the defendant to receive 60 in exchange for allowing the mill to resume operations. Thus, to prevent the plaintiff from inefficiently enforcing the injunction, the defendant must pay the plaintiff 36.

Notice that whether or not the mill can actually survive the injunction has no affect on the bargaining outcome. The only issue is the plaintiff's perception of the likelihood that the mill can survive. Even if the mill will fail for sure, the defendant will still have to pay 36 (unless he can prove to the plaintiff that the mill will fail). By the same token, the defendant only has to pay 36 even if he knows he can survive the injunction (and, in this case, he has no incentive to correct the plaintiff's misperception). Moreover, notice that the plaintiff obtains a larger payment the more optimistic he is (or, at least, the more optimistic he can convince the defendant he is) about the probability that the mill will survive. Even if this optimism is misplaced, the mill owner still must pay the plaintiff an amount that the plaintiff believes would make him as well off as if he were to obtain the injunction. Thus, uncertainty about the reversibility of a

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[53] The settlement creates a surplus of 80 (100-20). If the parties split the surplus equally, then the plaintiff must receive 60 (20+40) for agreeing to waive the injunction.

threat of inefficient performance creates an outcome that is in between the two polar cases of certain reversibility and certain irreversibility.

Now consider what happens when there is uncertainty about the benefits or cost of performance and the inefficient performance threat is irreversible.[54] First, note that if this uncertainty is symmetric, it should have no affect on the above analysis. If both sides have the same views about the different possible benefits and costs that performance would create, then (as long as they are both risk neutral) they will both just consider the average benefits and costs. Where the analysis changes is when the parties are asymmetrically informed. The natural form this asymmetry will take is that one party (X) knows her benefit or cost from performance but the other only knows something about the probability of different possible benefits or costs that X might obtain from performance. There are two distinct situations here: the party threatening inefficient performance does not know the cost or benefit of performance for the other side or the party being threatened by inefficient performance does not know the cost or benefit of performance for the threatening party.

In the case where performance is irreversible, the fact that the threatening party does not know the cost or benefit of the other party has no effect on the bargaining outcome. To see this, recall that when the threat is irreversible, the threatening party can only receive the payoff she would get from performance. For example, if the farmer in *Peevyhouse* does not know exactly how much it will cost the mining company to restore the topsoil to his land this will not change the fact that the mining company need only give the farmer a cash amount equal to his benefit from having the topsoil returned. The general principle here is that because the expected

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[54] I do not discuss the effect of uncertainty on reversible performance threats since Ayres and Madison's analysis of uncertainty applies to this case. See *supra* note 4 at 95.

payment for irreversible threats depends only on the benefit of performance if the threatening party is the plaintiff (or the cost of performance if the threatening party is the defendant), uncertainty about the cost of performance (or the benefit of performance when the defendant is threatening party) is irrelevant.

The situation is very different, however, when the party being threatened by irreversible inefficient performance does not know the benefit or cost of that performance to the other side. For example, suppose that the mining company in *Peevyhouse* does not know exactly how much value the farmer places on having his topsoil returned. To be concrete, say that both sides know it will cost the mining company $30,000 to return the topsoil to its original position, but only the farmer know exactly how much that is worth to him. The mining company only knows it is equally likely to be anywhere between $5,000 and $25,000. Notice that performance is always inefficient, but the defendant does not know just how inefficient it is.

To analyze the bargaining outcome in this situation, first consider the simple bargaining procedure where only the defendant can make an offer, and the plaintiff must either accept the offer or reject and force specific performance. The larger the offer the defendant makes, the more likely the plaintiff will accept, but the more the defendant will have to pay when the plaintiff does accept. If the defendant offers $25,000, for example, the plaintiff will always accept, so the defendant will always have to pay $25,000. This is clearly better than offering $5,000, since the plaintiff will always reject this offer and the defendant will then always have to pay $30,000 to perform. If the defendant offers $15,000, then the plaintiff will accept half the time (when his benefit is between $5,000 and $15,000) and reject half the time (when his benefit is between $15,000 and $25,000). So, the defendant's expect cost from offering $15,000 is $(1/2)*$15,000+(1/2)*(30,000)=$22,500$. One can show that the defendant's optimal offer in this

case is actually slightly higher, $17,500, meaning that slightly less than half the time there is no settlement and inefficient performance actually occurs. More generally, in this example if the defendant's cost of performance is C and this is greater than $25,000, the defendant's optimal offer is $(C+\$5,000)/2$.[55]

One important fact to notice about this is that the defendant's expected payment is no longer independent of his cost of performing. The greater the cost of performance, the more important it is to the defendant to reduce the risk that he will have to perform. This makes him willing to offer more to the plaintiff to reduce the risk that the offer will be rejected. Of course, this is only true up to some point. If the defendant's cost of performance were over $45,000, then he would offer the plaintiff $25,000 no matter how much over $45,000 his cost of performance was. By offering $25,000, the defendant ensures that the plaintiff will accept, so there is no risk that he will ever actually have to perform, making his cost of performance irrelevant again.

A second important fact is that uncertainty can sometimes lead a plaintiff who values performance less than the damages a court would offer to choose specific performance over damages. To see this, imagine that a court in this example would award damages of $15,000 since that is the average value of the plaintiff's benefit from having the contract performed. Because the defendant will offer $17,500 to be relieved of his duty for specific performance, the

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[55] To see this, realize that the defendant's expected payment from an offer of Z is $Z*(Z-5,000)/20 + C*(25,000-Z)/20$. The first term is the defendant's payment when the plaintiff accepts the offer times the probability that this will occur. The second term is the defendant's expected payment when the plaintiff rejects his offer times the probability that this will occur. To find the Z that minimizes this expected payment, take the derivative of this expected payment with respect to Z, set it equal to zero and solve for Z. This produces the equation $(2*Z-(\$5,000+C))/20,000=0$, whose solution is $Z=(C+\$5,000)/2$.

plaintiff will choose specific performance regardless of how much he values performance. By doing so, he has the choice between $17,500 and performance, which must yield a higher payoff than $15,000.[56]

At this point, it now looks like the Ayres and Madison's arguments retain their force, even for irreversible threats, once one considers the effect of uncertainty and asymmetric information. It is certainly true that when the threatened party does not know the benefit or cost of performance for the threatening party, that Ayres and Madison's concerns about the problem of threatening inefficient performance do apply to irreversible as well as reversible threats. That said, because the source of the problem is uncertainty rather than bargaining leverage, their suggested solutions do not fix the problem. To see this, consider the modified *Peevyhouse* example I have been analyzing. Now say that the defendant has the option of making specific performance inalienable. It is now true that the plaintiff will only choose specific performance

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[56] It is interesting to note that even if court awarded damages are higher, a plaintiff who values performance less than the amount of the damages may still sometimes choose specific performance over damages. For example, say that damages were $20,000. If a plaintiff chose damages whenever his benefit from performance was less than $20,000, then it would be optimal for a defendant to offer a plaintiff that chose specific performance more than $20,000. In which case, it would not be optimal for any plaintiff to choose damages over specific performance. This issue arises whenever damages are over $17,500. In this case, a plaintiff must choose specific performance such that the defendant's optimal offer given the plaintiff's rule for choosing specific performance is exactly the amount of court awarded damages. So, in this example, the plaintiff must choose specific performance whenever his benefit from performance is at least $10,000. If he follows this rule, the defendant's optimal offer for plaintiff's who choose specific performance is $20,000. In this situation, the plaintiff has no other strategy that can produce a higher payoff. If his benefit is below $20,000, he receives $20,000 whether he chooses damages or specific performance. If is benefit exceeds $20,000, he chooses specific performance, rejects the defendant's offer, and receive the benefit of performance.

rather than damages of $15,000 if he values performance at least $15,000. So, a plaintiff that values performance at less than $15,000 will not threaten inefficient performance. But, this does not make the defendant better off on the average. If it did, the defendant could simply have offered $15,000, but I have already shown the defendant is better off offering $17,500 than $15,000. The average plaintiff is worse off as well, since a plaintiff whose benefit is below $15,000 receives only $15,000 rather than $17,500. A plaintiff with a benefit between $15,000 and $17,500 receives his benefit rather than $17,500. In both cases the plaintiff is worse off. If the plaintiff's benefit exceeds $17,500, he does equally well under both regimes since he forces performance under either rule.

Of course, since Ayres and Madison propose giving the defendant the option to choose inalienability, this rule does not make things worse in this situation since the defendant will never choose this option. Even if the defendant as the right of private additur, the situation does not change. Taken together, private additur and an inalienable injunction produce the same result as with alienable injunctions. If the injunction were inalienable, the defendant would want to add to damages so that the damages were exactly equal to the amount he would offer the plaintiff to waive an alienable injunction. So, while Ayres and Madison's proposed remedies do not make this situation any worse, they do not fix the problem of threats of irreversible inefficient performance when there is information asymmetry.

When information asymmetry gives one party the ability to use threats of inefficient performance to her advantage, the only way to remedy this problem is not use equitable relief at all. If the court is sure that performance is efficient, if it awards damages rather than an injunction or specific performance, then it can ensure that inefficient performance does not take place. When there is asymmetric information, awarding equitable relief always creates the

possibility that the parties will not be able to reach an efficient agreement that waives the defendant's duty to perform. That said, since in many cases a court will not be able to tell for sure if performance is inefficient, a blanket rule against equitable relief is not desirable.

Of course, one might reasonably object to this entire analysis based on the fact that I have assumed that the defendant (or, more generally, the threatened party) can make a take it or leave it bargaining offer to the plaintiff (or, more generally, the threatening party). This objection is particularly forceful given that the main point of this article is that one should not predict bargaining outcomes based on arbitrary bargaining solutions that are not appropriate for the situation. It turns out, however, that even in a more general bargaining model where both sides can make offers, that the bargaining outcome should look almost exactly like it does in the situation where the defendant makes a take it or leave it offer. This follows from a bargaining result I have proved in another paper.[57]

The intuition for this result is as follows. There are two distinct possibilities that can occur when there are more rounds of bargaining. Either a plaintiff can bargain exactly the same way (up until the point where she accepts an offer by the defendant) regardless of how much she values performance or a plaintiff's bargaining strategy can depend on how much she values performance. One can rule out the second possibility by noting that the defendant could then use the plaintiff's bargaining behavior to make a more precise estimate of how much she valued performance. Then, she would be willing to make a larger offer to a plaintiff who bargained like she placed a higher than average value on performance. But, in that situation, even a plaintiff

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[57] See Abraham L. Wickelgren, *Unobservable Preparation and the Inevitable Risk of Conflict*, unpublished manuscript available from the author upon request.

who placed a low valuation on performance would want to bargain that way, so the plaintiff's bargaining strategy would not depend on the value she places on performance.[58]

Thus, adding more rounds of bargaining cannot allow the defendant to determine any more precisely exactly how much the plaintiff values performance. So, the defendant's optimal strategy remains the same, to only offer $17,500 for the right to not have to perform. The plaintiff will never want to make a lower offer since then she would earn less. The defendant will never accept a higher offer, or else a plaintiff will make this offer regardless of how much she values performance. Then it would be as if the defendant were making an offer above $17,500, which we saw above was not optimal. So, the only remaining possibility is that the defendant pays $17,500 to the plaintiff if the plaintiff values performance less than that, otherwise the plaintiff enforces performance.

To summarize the results of this section, notice that there are three different effects from different types of uncertainty. Uncertainty has no affect on the analysis of the perfect certainty situation if both sides are equally uncertain about the costs and benefits of performance or if the threatening party does not know exactly how much performance costs (or benefits) the threatened party. On the other hand, if there is uncertainty about the reversibility of performance, then one can expect a bargaining outcome that falls in between the two polar cases of certain reversibility and certain irreversibility. Lastly, if the threatened party does not know

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[58] The only way a high valuation plaintiff can signal her type is by enforcing performance (the defendant will never perform without being forced to by the plaintiff). The defendant will always want to make one last offer before the plaintiff enforces performance. The defendant would only offer above $17,500 at this point if the plaintiff's bargaining behavior up to this point indicated that she was more likely to value performance highly. But, if the defendant did make a larger offer, then even a plaintiff who valued performance less highly would want to bargain the same way so as to obtain a larger offer from the defendant.

how much the threatening party will benefit from performance (or how much performance would cost her), then the threatening party can sometimes use the threat of irreversible inefficient performance to extract a payment from the other party for non-performance that exceeds the payoff the threatening party would receive from performance.[59] So, this form of uncertainty creates a bargaining outcome that looks very similar to the bargaining outcome that Ayres and Madison postulate. But, because this outcome is driven by uncertainty rather than bargaining leverage derived from the threat of inefficient performance, the solutions that Ayres and Madison propose (and which work well when the threat is reversible) do not undo the ability of one side to use its informational advantage to sometimes receive a payment that exceeds its payoff from performance. Thus, uncertainty does not change the fact that analysis of irreversible threats of inefficient performance is fundamentally different from analysis of reversible threats.

VI. Conclusion

This article should not be read as suggesting that all these prior articles that used the Nash bargaining solution are completely invalid. They all make important points, but, because they use a bargaining solution that is only appropriate in a limited range of circumstances, they are not as generally applicable as they initially appear to be. That said, the main point of this article is not to critique past results but to provide guidance for future research involving bargaining. Since a more careful and detailed model of the bargaining process is essential to generate robust

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[59] I say sometimes, because the threatening party only receives a higher payoff by making this threat if its payoff from inefficient performance is low enough. If its payoff from inefficient performance is sufficiently high, then it will have to enforce performance even though doing so is inefficient.

conclusions, hopefully this essay will encourage scholars to explicitly model the bargaining

problems that arise in their work rather than taking the shortcut of relying on the Nash bargaining

solution.