Asset Specificity and Inefficient Bargaining: Theory and Evidence from Television Shows

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Abstract. Evidence from TV shows suggests that failed contract negotiations may lead to inefficient show cancellation. We propose a theoretical model of bargaining with asymmetric information that allows for this possibility. We derive various testable implications, all of which are borne by the data. We show that an increase in asset specificity of the actor-show match implies an *increase* in the probability of an agreement under efficient bargaining but a *decrease* under asymmetric information. We use this result as an identification strategy to place a 3% lower bound on the probability that a TV show is cancelled even though it would be efficient for it to continue.

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1. Introduction

The majority of multi-episode television shows — from sitcoms to court-room dramas — last for multiple seasons. Although many contracts include long-term provisions, it is common for contract negotiations to take place at the end of a season. In this context, extension decisions (will the show continue next season?) are frequently fodder for media hype, at times reaching higher levels of drama than the show itself. These extension decisions are also interesting from an economics point of view, as they combine key concepts from game theory and contract theory: outside options and bargaining power, asymmetric information and efficiency, asset specificity and hold-up, to name a few.

In this paper, we focus on the extension decision of television shows.[1] By means of a motivating example, consider the show *On My Block*, the Netflix teen comedy-drama series centered on the lives of a group of teenagers in a tough LA neighborhood. The show's top stars each earned $200,000 per season during the first two seasons. *On My Block* was Netflix's most-binged show in 2018, the year it was first released. This unexpected success prompted the cast to negotiate a better deal for season 3, initially pushing for $250,000 per episode per actor. After Netflix reportedly countered with a $45K offer, the two sides eventually agreed to $650,000 for the season, which came to $81,250 per episode (Netflix decided to produce eight shows only during season 3). The pre-season 3 agreement also included the provision for an increase to $850,000 for a potential fourth season and $1.05 million for a potential fifth (**?**, **?**).

Netflix's Cindy Holland acknowledged that the actors "did pretty well in its first season" and that "people have fallen in love with the characters and that cast" (ibid). *On My Block*'s popular appeal remained high throughout its life. For example, IMDb episode ratings averaged 7.25, 7.44, 7.43, 7.35 over the show's four seasons. Why was it then not renewed after season 4? One explanation is that Netflix had different plans all along. A tantalizing alternative explanation, however, is that "it [had] little to do with popularity" but rather "most likely [had] to do with money," that is, with the prospect of paying an excessive wage bill (**?**, **?**).

Days before the last episode of season 4 was released, Netflix ordered the spin-off show *Freeridge* (the fictional neighborhood where *On My Block* was set). *Freeridge*, which features a different cast from *On My Block*, was released in February 2023 (eight episodes), but in April Netflix announced it was cancelling the show after the first season.

Anecdotal evidence suggests that the pattern of events found in *On My Block* is also present in other shows. Following early success, the show's key actors become more popular and, possibly, more critical to the show's success (that is, their talent is a match-specific asset). Emboldened by this sudden increase in power, the cast asks for more. The result is that actors do get more, but also that there is a chance the show is not renewed, possibly inefficiently so (to the extent that the actors' outside option is worth less than the future wage they bargained for).

Our goal is to analyze the dynamics of show renewal from an economics perspective. From a theoretical point of view, we have many modeling paradigms to choose from. However, not all are equally appropriate to address the patterns described above. For example, recent structural empirical IO work (e.g., **?**, **?**) models negotiated prices as arising from

1. For simplicity, we use "TV shows" as a generic concept that includes both linear television and streaming.

a Nash-bargaining surplus-splitting rule, that is, in a complete information framework. In this context, an agreement is always reached when such an agreement is efficient, thus precluding the possibility of inefficient show terminations. Coalitional equilibrium concepts such as the Core or Shapley value suffer from the same limitation.

? show that it is generally impossible to find efficient bargaining mechanisms in the presence of two-sided asymmetric information.[2] This suggests that asymmetric information provides a natural path to model the possibility of inefficient bargaining breakdown. However, the literature on non-cooperative bargaining with two-sided asymmetric information suggests that the outcome may depend delicately on details of the game's extensive form. Moreover, there may exist multiple equilibria.

Anecdotal evidence from TV show negotiations suggests that there is no clear negotiations protocol and that both sides have private information. In order to deal with this problem, we propose a simple extensive form that may be thought of as the reduced form of a potentially complicated (possibly protocol-free) negotiations process. Specifically, we assume that the bargaining parties have private information about their outside option and that Nature allows one of the parties to make a take-it-or-leave-it (TIOLI) offer to the other party. Moreover, we assume that the probability that each party gets to make such TIOLI offer is increasing in that party's bargaining power. This model has several desired features. First, each party's payoff from a negotiated agreement is increasing in their bargaining power. Second, and more important, the model allows for the possibility of inefficient bargaining failure (in the present context, a show that, inefficiently, is not extended).

The model suggests a series of testable empirical implications. We show that the probability of a show's extension is: (a) increasing in the show's value (which we measure by user ratings); (b) decreasing in the quality of the cast (which we measure by the actor's historical success in billing order); and (c) decreasing in the degree of talent match specificity (which we measure by how regular the top cast is over the show's history). The latter prediction requires that there is substantial private information on the producer's side, which we argue is the case.

Our reduced-form analysis estimates are consistent with these predictions. Our estimates imply that: (a) a one-standard deviation increase in IMDb rating is associated with a 3.5% increase in the probability of extension (from a baseline of 69%); (b) a one-standard deviation increase in cast talent is associated with a 2.6% decrease in the probability of extension; and (c) a one-standard deviation increase in the degree of match specificity is associated with a 1.7% decrease in the probability of extension.

We then use the theoretical model as a lens with which to interpret the empirical estimates. We show theoretically that, under efficient bargaining, the probability of an agreement is *increasing* in the degree of match specificity. Intuitively, the more match-specific the value of actors, the lower the combined outside option, while the value of an agreement remains constant. However, in equilibrium with asymmetric information, the probability of an agreement is *decreasing* in the degree of match specificity.

The contrast between the efficient and the equilibrium solutions, together with our empirical estimates, provide strong evidence of bargaining inefficiency. It also suggests a

2. More specifically, when the supports of buyer and seller types overlap, there does not exist any incentive-compatible, individually rational bargaining mechanism that is ex-post efficient and that also satisfies an ex-ante balanced budget.

strategy for placing a lower bound on the extent of bargaining inefficiency, that is, a lower bound on the probability that a show is canceled even tough it would be efficient for it to be extended. In fact, any increase in the probability of a breakdown resulting form an increase in talent specificity can be ascribed to bargaining inefficiency.

Following this process, a conservative estimate of the probability of inefficient breakdown is given by the effect of a one-standard deviation increase in talent specificity. Different econometric specifications lead to somewhat different values, from 1.72 to 3.23%. We believe this is a sufficiently high value to warrant a careful examination of the importance of inefficient bargaining.

■ **Related literature.** Recent empirical IO research typically models negotiated prices as arising from a Nash-bargaining surplus-splitting rule, that is, in a complete information framework. See, for example, **?**, **?**, **?**, **?**, **?**. In this context, there is no negotiations breakdown by assumption. **?** show that information is valuable and suggest that asymmetric information is an important component of negotiations, but they do not explicitly model such negotiations process.

Some papers, however, explicitly allow for asymmetric information and the possibility of bargaining breakdown. In these papers, the structure of bargaining follows closely the particular features of the setting. **?** develops a model of pre-trial negotiation in criminal cases, allowing for the possibility of bargaining failures due to asymmetric information.[3] Like **?**, we consider a take-it-or-leave-it bargaining protocol (in his case, the prosecutor offers the defendant to settle for a sentence). One important difference is that we allow for the roles of maker and receiver of a TIOLI offer to vary depending on each player's bargaining power.

? develops a model of bargaining based on the actual institutional details of the car auction industry. When the highest bid is lower than the seller's (secret) reserve price, a period of alternating offers ensues. **?** assumes a cap on the number of offers and counter offers as well as a cost per offer, thus ensuring the process ends after a finite number of steps. About 10 percent of the time there is no agreement, some of which **?** suggests is due to bargaining inefficiencies. Our model differs in that in our case there is no set formal protocol for negotiations (or available data on offers and counter offers). In this sense, our paper is closer to the reduced-form empirical literature on bargaining mentioned earlier, with the difference that our main focus is on the possibility of failure to reach an agreement.

We believe our paper contributes to the literature in three ways. First, we propose a tractable model of bargaining that imposes relatively little structure on the bargaining process but allows for meaningful comparative statics. Second, we propose an identification strategy that allows us to place a lower bound on the probability of inefficient bargaining failure. And third, we provide evidence regarding the negotiations process in a specific industry.

3. See also **?**, which in turn is based on **?**. These papers too assume an extensive form with a TIOLI offer.

2. Theory

Consider a game played between a producer and an actor.[4] The producer's (net) value of an agreement for the actor to star in the show at a wage w is given by

$$v_1 = k + b - w + \epsilon_1^p \tag{1}$$

where $k \in \mathbb{R}^+$ stands for actor talent (human capital), $b \in \mathbb{R}^+$ reflects other sources of value (e.g., script), w is the wage paid to the actor, and $\epsilon_1^p \in \mathbb{R}$ measures a residual value which is the producer's private information. If no agreement is reached, then the producer's outside option is worth

$$v_0 = (1 - s)\, b + \epsilon_0^p \tag{2}$$

where $s \in [0, 1]$ measures the producer-actor match degree of asset specificity and $\epsilon_0^p \in \mathbb{R}$ measures a residual value which is the producer's private information.

The above formulation implicitly assumes that there is a competitive market for actor talent k at a cost $w = k$.[5] Therefore, if $s = 0$, then the producer can hire any actor with talent k at a wage $w = k$ and get a net value $b + \epsilon_1^p$. At the opposite extreme, if $s = 1$, then the value b is destroyed when the current actor departs, leaving the producer with an outside option worth ϵ_0^p.

Since the producer's critical choice is between v_1 and v_0, the producer's private information can be summarized by the value of $\epsilon_p \equiv \epsilon_0^p - \epsilon_1^p$. We assume that ϵ_p is distributed according to $F(\epsilon_p/\sigma_p)$, where σ_p measures the degree of private information (and p stands for "producer"). We assume that $F(0) = 0$, that there exists a $\overline{\epsilon} \in (0, s\, b)$ such that $F(\overline{\epsilon}) = 1$, and that $f(\epsilon) > 0$ for $\epsilon \in [0, \overline{\epsilon}]$. Finally, we assume that F is continuously differentiable and that $H(x) \equiv F(x)/f(x)$ is strictly increasing. These assumptions ensure that the equilibrium is "interior" (that is, based on the players' first-order conditions for payoff maximization). These assumptions also allow us to model an increase in the degree of private information in a natural way, as we will see below.[6]

Regarding the actor, we assume that his value from an agreement is given by

$$u_1 = w + \epsilon_1^a \tag{3}$$

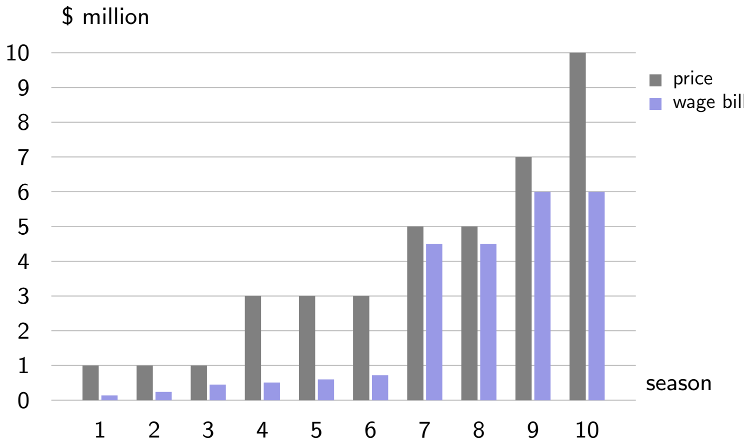
whereas his outside option is given by

$$u_0 = k + \epsilon_0^a \tag{4}$$

Similar to the producer, we define $\epsilon_a \equiv \epsilon_0^a - \epsilon_1^a$ and assume that it is distributed according to $F(\epsilon_a/\sigma_a)$, where ϵ_a is the actor's private information and σ_a measures the actor's degree of private information.

4. While for simplicity we cast our analysis in terms of a producer-actor game, the qualitative results in this section should be of more general interest.
5. This assumption simplifies the analysis but is not strictly speaking required for the main results. That said, **?** presents evidence consistent with $w = k$: He shows that a higher k implies a higher movie revenues but not higher movie profits.
6. The assumption that $H \equiv F/f$ is strictly increasing is common in various settings (e.g., auction theory) and is satisfied by various distributions. In a pricing context where the demand curve is given by $1 - F$, the assumption that H is strictly increasing is equivalent to the assumption that the marginal revenue curve is strictly decreasing.

Figure 1
The evolution of *Friends*: 1994–2002. Source: **?**. Note: wage bill for seasons 8-10 does not include revenue sharing payments.



In principle, any bargaining procedure under incomplete information can be recast as a direct revelation game (**?**, **?**). In this paper, however, we take the approach of modeling bargaining as an extensive form where each player has the opportunity to make a take-it-or-leave-it (TIOLI) offer with some probability. In this sense, our approach is closer to **?**, for example. Specifically, the extensive form of the negotiation game between producer and actor is as follows. With probability $T(k, s)$, the actor is able to make a take-it-or-leave-it (TIOLI) offer to the producer, specifically a salary w that the actor requires to continue with the show. With probability $1 - T(k, s)$, the opposite happens: the producer is able to make a TIOLI offer to the actor (also a salary w). We assume that $T(k, s)$ is strictly increasing in k and s and that $T(k, s) \to 1$ as $s \to 1$. The idea is that, the greater the actor's talent or the uniqueness of his contribution to the show, the greater the actor's bargaining power, which is reflected in his ability to make a TIOLI offer (that is, the probability that the actor is able to commit to a TIOLI offer). And, in the limit when the actor is essential (in the sense that, without the actor, the value b is completely lost), then the actor gets to make a TIOLI offer for sure.

These assumptions regarding $T(k, s)$ are quite central to our argument. They thus require some justification. As a motivating example, consider the contrast between two leading NBC shows, *Friends* and *Law & Order*. *Friends* premiered on NBC on September 22, 1994. By the end of the second season, it was clear that *Friends* was a great success. Not surprisingly, the actors thought they could get a bigger slice of the pie: without them, there would be no show. By season 9, each actor was paid $1 million per episode plus a share in the show's revenues. Not only was this substantially more than the $22,500 they were paid during the first season, but the ratio between the wage bill paid by the producer, WBTV, and the price WBTV received from NBC, increased from 13.5% to 85.7% (see Figure **??**). Despite very solid ratings, the show was not continued beyond its 10th season.

Whereas *Friends* was very centered on a cast of characters, so that actor talent was a very match-specific asset, one of the distinctive features of *Law & Order*'s business model is that it is centered on the plot, rather than on the characters. Virtually nothing is known about the main characters, which implies that actor talent is not match-specific. As a result, cast changes are easy to implement — and indeed take place quite frequently: since 1992, every one of the main characters has been replaced at least once, sometimes three or four times. For example, in 2004 Annie Parisse, one of the leading actresses, announced she wanted to pursue a movie career. Producer Dick Wolf's reaction was typical: "It was: 'Oh, thank you for coming in early. You don't mind if we kill you, do you?'" In fact, in the season's last episode Ms. Parisse's character ends up "dead in the trunk of a car, a casualty of a drug-and-murder investigation left unresolved in anticipation of next season." Appropriately, Ms. Parisse was replaced by Alana De La Garza, whose character on *CSI: Miami* had been killed the previous season (**?**, **?**). *Law & Order* premiered on September 13, 1990, ran for 20 seasons, and, after a 11-year hiatus, is currently in its 22nd season.

The above anecdotal evidence seems broadly consistent with our assumption that $T(k,s)$ is increasing in k and in s. To conclude this section, we should also mention that the assumption that $T(k,s)$ is increasing in s is broadly consistent with the result in **?** that a seller can credibly play a take-it-or-leave-it strategy when bargaining with many buyers between whom the seller can costlessly switch.

■ **Equilibrium wage offer.** Consider the subgame when the actor makes a TIOLI offer. The offer is accepted by the producer if and only if $v_1 > v_0$, or simply

$$\epsilon_p < s\,b + k - w_a \tag{5}$$

where we use the subscript a to denote that the wage offer is made by a. The actor's expected payoff is then given by

$$\begin{aligned}\overline{u} &= \big(w_a + \epsilon_1^a\big)\; F\big((s\,b + k - w_a)/\sigma_p\big) + \big(k + \epsilon_0^a\big)\left(1 - F\big((s\,b + k - w_a)/\sigma_p\big)\right) \\ &= (w_a - k - \epsilon_a)\; F\big((s\,b + k - w_a)/\sigma_p\big) + k + \epsilon_0^a\end{aligned} \tag{6}$$

As often happens is optimal pricing problems, it is easier to consider the actor's choice of a probability of acceptance. Define

$$x_a \equiv (s\,b + k - w_a)/\sigma_p \tag{7}$$

which implies

$$w_a - k = s\,b - \sigma_p\,x_a \tag{8}$$

Then the actor's expected payoff (**??**) may be re-written as

$$\overline{u} = \big(s\,b - \sigma_p\,x_a - \epsilon_a\big)\; F(x_a) + k + \epsilon_0^a$$

The first-order condition for payoff maximization with respect to x_a is given by

$$-\sigma_p\,F(x_a) + \big(s\,b - \sigma_p\,x_a - \epsilon_a\big)\; f(x_a) = 0 \tag{9}$$

or simply

$$H(x_a) = -x_a + \frac{s\,b - \epsilon_a}{\sigma_p} \tag{10}$$

Consider now the subgame when the producer makes a TIOLI offer. The offer is accepted by the actor if and only if $u_1 > u_0$, that is,

$$\epsilon_a < w_p - k \tag{11}$$

where we use the subscript p to denote that the wage offer is made by p. The producer's expected payoff is then given by

$$\begin{aligned}\overline{v} &= \left(k + b - w_p + \epsilon_1^p\right)\, F\big((w_p - k)/\sigma_a\big) + \left((1-s)\, b + \epsilon_0^p\right)\left(1 - F\big((w_p - k)/\sigma_a\big)\right) \\ &= \left(k + s\, b - w_p - \epsilon_p\right)\, F\big((w_p - k)/\sigma_a\big) + (1-s)\, b + \epsilon_0^p\end{aligned} \tag{12}$$

Define

$$x_p \equiv (w_p - k)/\sigma_a \tag{13}$$

so that

$$k - w_p = -\sigma_a\, x_p \tag{14}$$

The producer's payoff can then be written as

$$\overline{v} = \left(s\, b - \sigma_a\, x_p - \epsilon_p\right)\, F(x_p) + (1-s)\, b + \epsilon_0^p$$

The first-order condition for payoff maximization with respect to x_p is given by

$$-\sigma_a\, F(x_a) + \left(s\, b - \sigma_a\, x_p - \epsilon_p\right)\, f(x_p) = 0 \tag{15}$$

or simply

$$H(x_p) = -x_p + \frac{s\, b - \epsilon_p}{\sigma_a} \tag{16}$$

Notice the similarity between (**??**) and (**??**). We next show that (**??**) and (**??**) have unique solution and "well-behaved" comparative statics:

Lemma 1. *The equilibrium values of x_a and x_p are unique. Moreover, the equilibrium probability that a TIOLI offer by player i ($i = p, a$) is rejected by $j \neq i$ is strictly increasing in σ_j, ranging from 0 when $\sigma_j \to 0$ to 1 when $\sigma_j \to \infty$.*

The proof of this and the next results can be found in the Appendix. Note that, by (**??**) and (**??**), uniqueness of x_i ($i = a, p$) implies uniqueness of w_i as well.

The second part of Lemma **??** states that, if a makes a TIOLI offer to p, then the higher σ_p is, the more likely the optimal offer (which depends on σ_p) is rejected. Similarly, if p makes a TIOLI offer to a, then the higher σ_a is, the more likely the optimal offer (which depends on σ_a) is rejected. Basically, Lemma **??** shows that our modeling strategy does indeed reflect the idea that private information leads to bargaining inefficiency. This is consistent with the general thrust of the economics literature on bargaining with asymmetric information, beginning with **?**'s (**?**) seminal work. It is also akin to the result that monopoly pricing leads to an inefficient outcome, namely pricing offers that are rejected by potential buyers whose valuation is greater than marginal cost.

■ **Comparative statics.** Let r be the probability that an agreement is reached. Let r_i ($i = a, p$) be the probability that an agreement is reached given that i is making a TIOLI offer. From (**??**) and (**??**),

$$\begin{aligned} r_a &= F\big((s\, b + k - w_a)/\sigma_p\big) \\ r_p &= F\big((w_p - k)/\sigma_a\big)\end{aligned}$$

where w_a and w_p are determined by x_a and x_p and the latter are implicitly given by (**??**) and (**??**). Let $T(k,s)$ be the probability that Nature chooses a to make a TIOLI offer. Then

$$\begin{aligned} r &= T(k,s)\, r_a + \big(1 - T(k,s)\big)\ r_p \\ &= T(k,s)\, F(x_a) + \big(1 - T(k,s)\big)\ F(x_p) \end{aligned} \tag{17}$$

Our first set of results concern the comparative statics of r.[7]

Proposition 1. *r is increasing in b. If σ_a is sufficiently small, then r is decreasing in k. If in addition b is also sufficiently small, then r is decreasing in s.*

The proof may be found in the Appendix. Before discussing Proposition **??**, it is worth mentioning that the conditions that σ_a and b are small are sufficient but not necessary conditions. In a way, the empirical part of the paper is as much as test of the theoretical results as it is a test of the underlying assumptions.[8]

The intuition for the comparative statics with respect to b is similar to the effect of an expansion in a demand curve: it leads to an increase in p but also to an increase in q. In the present context, p is actor wage and q is the probability that the offer is accepted, that is, $F(x_i)$.

The intuition for the comparative statics with respect to k and s is that, by assumption, an increase in these variables leads to an increase in $T(k,s)$. In plain English, when an actor becomes more valuable or more unique to a show, that actor's bargaining power increases, which we measure by a higher probability $T(k,s)$ of making a TIOLI offer. The assumption that σ_a is very small implies that shifting power to the actor increases the likelihood of a bargaining breakdown. In fact, to the extent that there is private information on the producer's side (but not on the actor's side), a shift in bargaining implies an increase in the probability of an offer to the side that has private information. The assumption that b is small is important because the "direct" effect of an increase in s is to increase the relative value of an agreement (as the alternative becomes less valuable), an effect that goes in the opposite direction of the shift in bargaining power.

Regarding the condition that σ_a is small, **?** suggest (in the context of feature films) that there is a well-defined market for actor talent. This is consistent with the idea that residual private information on the producer's side is more important than on the actor's side, which $\sigma_a \approx 0$ captures in an extreme way. In other words, we believe there is supporting evidence for our assumption that there is less private information on the actor's side. We might also add that, as the distribution model becomes more and more centered on streaming, the extent of private information by the producer is likely to become more significant. For example, much of the information relevant to the success of a Netflix show is Netflix's private information.

■ **Bargaining efficiency.** The analysis so far has been exclusively positive: understanding the factors that lead to a show's extension. We next turn to normative analysis: understanding when it is efficient for a show to be extended. We say that it is efficient for an agreement to be reached (and the show to be extended) when the total value from such an

7. **?** presents a related, but different, comparative statics in the context of pre-trial negotiations.

8. We should also note that, when we state that b is sufficiently small, formally we mean that there exists a $b' > 0$ such that, if $b < b'$, then the result holds.

agreement is greater than the alternative. From (**??**) and (**??**), the joint value of from an agreement is given by

$$u_1 + v_1 = (w + \epsilon_1^a) + (k + b - w + \epsilon_1^p)$$

From (**??**) and (**??**), the joint value from *not* agreeing to an extension is given by

$$u_0 + v_0 = (k + \epsilon_0^a) + ((1 - s)\, b + \epsilon_0^p)$$

It follows that a show extension is the efficient outcome if and only if $u_1 + v_1 > u_0 + v_0$, or simply

$$s\, b > \epsilon^a + \epsilon^p$$

Intuitively, the left-hand side is the lost value from not coming to an agreement, whereas the right-hand side is the match-specific joint utility shock from an agreement. This leads to the following result:

Proposition 2. *Under efficient bargaining, the probability that a show extension is efficient is increasing in s.*

The intuition for Proposition **??** is fairly straightforward: As s increases, the alternative to a negotiated agreement becomes less attractive. Therefore, the probability that an agreement is the efficient outcome, that is, the probability that $s\, b > \epsilon^a + \epsilon^p$, increases.

The combination of Propositions **??** and **??** provides a strategy for both testing our theory of negotiations and estimating the extent of bargaining inefficiencies. Proposition **??** states that, everything else constant, the greater the degree of asset specificity, the more likely it is for efficiency to dictate that an agreement should be reached. However, Proposition **??** states that, in the presence of asymmetric information, negotiations may break down, and moreover the probability that this happens is increasing in the degree of asset specificity (due to the shift in bargaining power). For these reasons, we argue that a negative relation between r and s provides evidence of bargaining inefficiency.

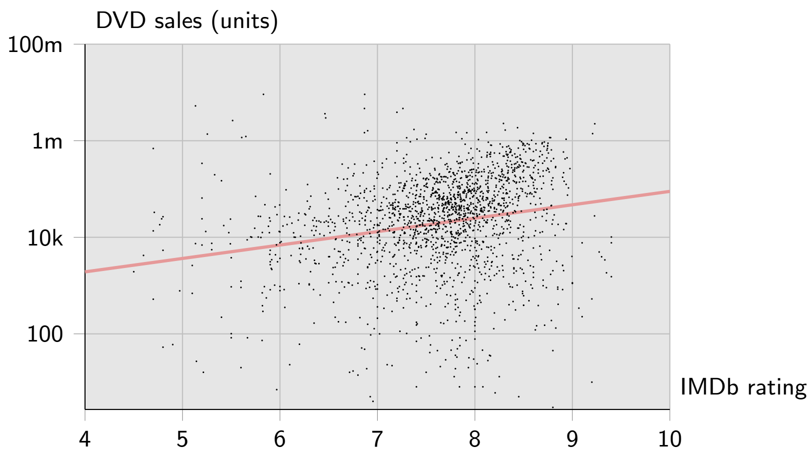
We are unable to tell whether a particular negotiation should have led to an agreement or not (in efficiency terms). However, when we observe an increase in the probability of a negotiations breakdown resulting from an increase in s, we can attribute such an increase to bargaining inefficiency. In fact, efficiency considerations dictate that the probability of an agreement should have increased, not decreased. This allows us to place a lower bound on the extent of bargaining inefficiency.

In Section **??** we test Proposition **??**, whereas in Section **??** we estimate a lower bound on the extent of bargaining inefficiencies. Before than, in the next section we describe the data we use in Sections **??** and **??**.

3. Data

We draw data from the raw IMDb files publicly available in March 2016, which allow us to assemble a data set at the show-season level for all shows that were released in the US from 1970 until 2014. The IMDb files identify TV programming episodes that belong to different seasons of different shows as well as actors participating in those episodes and user ratings at the episode level. We have data for 3,243 shows, some of which last for one season, a few for more than 20 seasons. Each season, a show typically comprises several episodes. Shows can be of different kinds: comedy, documentary, drama, and so on.

Figure 2
IMDb rating and DVD sales.



In order to test our theory, we need to measure the variables r, b, k, and s at the show-season level. We next turn to each of these.

■ **Show extension (r).** In our theoretical model, r is the probability that a given show is extended into an extra season. Obviously, we cannot measure such a probability directly. Instead, we create a dummy variable, at the show-season level, that takes the value 1 if the show is continued for at least one more season.

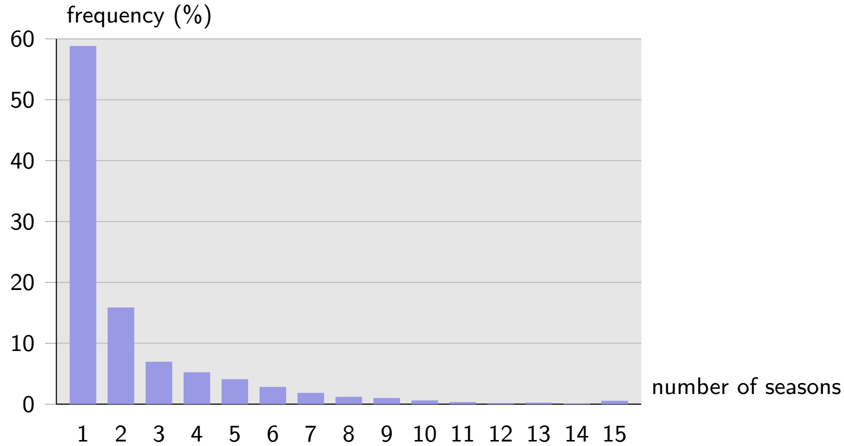
■ **Show value (b).** As a proxy for the value of a given show, we use the average IMDb user ratings of all episodes in a given season. We note that user ratings information is time invariant in our source. In other words, we only observe the total rating as of 2016. Since ratings are at the episode level, for a given show we obtain a time varying series b.

We believe IMDb user ratings provide a good proxy for show value. Figure **??** illustrates the relation between IMDb ratings and DVD sales during the 2000–2009 period, a period when DVD sales represented a significant fraction of revenues. While there is considerable variation, we observe a clear positive correlation between the two measures. A simple log-linear regression yields coefficient of 0.6397 (estimated with a p value lower than 2E-16), implying that a 1 point increase in IMDb rating is associated with a 64 percent increase in DVD sales.

■ **Talent (k).** Next we turn to a measure of actor's human capital, k. IMDb data includes a registry of acting credits, specifically the billing order of the talent participating in each episode. From this registry, we take the top three billed actors. We first count all distinct TV shows, feature films, TV films, or video films in which each given actor of a show's top three billed actors has participated in the past up to the current year. We then average this count over the top 3 actors and express it in natural logarithms. As a robustness measure, we do the same calculations but considering top 5 rather than top 3.

■ **Talent specificity (s).** We measure asset specificity, s, by the persistence of actors

Figure 3
Histogram of total number of seasons by show. Rightmost bin include all shows with 15 or more seasons.



throughout a show's history. For each top-3 actor, we measure the percentage of all episodes (in all seasons, up to the current season) when the actor was billed top 3. Then, for the current season, we take the average of this variable across all actors billed top 3 during the current season. As a robustness measure, we do the same calculations but considering top 5 rather than top 3.

■ **Other variables.** The genre of each show is available for 98.8% of shows; we assign those without a genre to an undefined genre category. When more than two genre classifications are available on each show, we only assign these shows the two most common genre categories in the sample, thus reaching 99 blends of genres (for instance, action-drama).

■ **A first look at the data.** Figure **??** shows the distribution of our 3,243 shows in terms of number of seasons. While the average count of seasons per show is 2.95, there is considerable variation across shows. Almost 60% of all shows last for one season only, and the distribution is highly skewed.

As an illustration of the variety of shows in our sample, Table **??** provides a few examples. One variable that plays a central role in our theory of show extension is actor talent specificity. Among the particular examples considered in Table **??**, it takes the lowest value with *Are You Afraid of the Dark?*, a show where "a group of teenagers meet in the woods, and tell scary stories." Ross Hull, the actor with the most episodes, appeared 68 times from 1990–2000. However, most actors appeared in a much lower number of episodes during the show's seven seasons. This explains the low value of the talent specificity variable: Actors on *Are You Afraid of the Dark?* come and go, and the show is not particularly dependent on a particular actor. By contrast, shows like *Friends* or *Veep* score 1 on actor specificity. In fact, the leading three actors appeared on every episode.

A quick scan through the data on Table **??** fails to show a clear relation between talent specificity and the number of seasons. However, we must recall that the number of seasons results from a variety of factors, including the show's popularity. The purpose of our analysis

Table 1
Some examples of show-level observations in the data

Show title	Num. seasons	Start year	End year	Talent	Talent specificity	IMDb rating
30 Rock	7	2006	2012	11.46	0.91	8.12
Are You Afraid of the Dark?	7	1990	2000	1.73	0.03	8.18
Arrested Development	5	2003	2013	14.13	0.99	8.52
Breaking Bad	5	2008	2012	13.73	0.98	8.98
Friends	10	1994	2003	12.23	1.00	8.52
Gold Rush: Alaska	5	2010	2014	1.28	0.14	6.81
Law & Order	20	1990	2009	10.08	0.56	7.73
Lost	6	2004	2010	8.17	0.53	8.68
Mad Men	7	2007	2014	13.43	0.97	8.53
Paranormal Witness	3	2011	2013	1.76	0.08	7.75
Seinfeld	9	1989	1997	4.96	0.93	8.48
The Sopranos	6	1999	2006	12.50	0.96	8.68
The Wire	5	2002	2008	5.40	0.68	8.84
The X Files	9	1993	2001	8.65	0.19	8.10
Veep	3	2012	2014	15.89	1.00	8.19

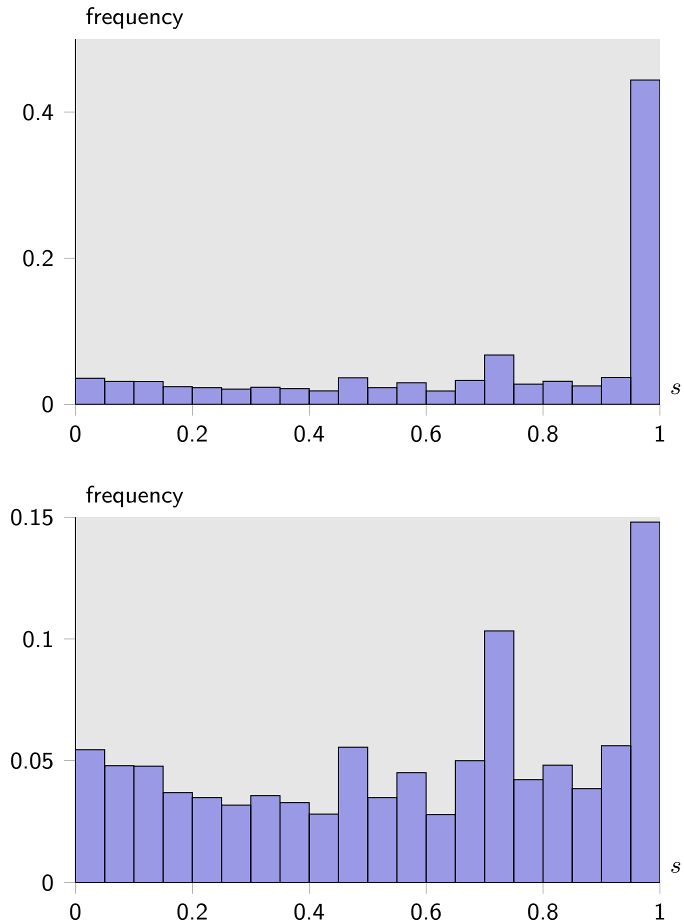
Table 2
Summary statistics at the show-season level

var	desc	count	mean	std	min	25%	50%	75%	max
r	Show renewal dummy	7474	0.69	0.46	0.00	0.00	1.00	1.00	1.00
b	IMDb rating	7474	7.53	1.00	1.10	7.10	7.68	8.16	9.90
s	Talent specificity	7474	0.72	0.32	0.01	0.50	0.86	1.00	1.00
k	Talent quality (in logs)	7474	1.95	0.74	0.00	1.39	1.98	2.51	4.50

is precisely to examine the separate contribution of each variable to the likelihood that a show is extended into the next season, and ultimately for how many seasons it lasts.

Table **??** reports summary statistics of the main variables, at the show-season level, that we will use in our regressions. Variable s plays a central role in our analysis, and as such warrants special attention. Figure **??** plots the distribution of s in bins of 0.05 width. As can be seen from the top panel, the distribution is very skewed, with considerable mass in the top bin. In fact, we note that 35% of our observations have s exactly equal to one: the top 3 cast is present in each and every of the show's episodes. If we exclude these observations with $s = 1$, then we obtain a rather more even distribution, as can be seen in the bottom panel of Figure **??**. In the regressions we present in Section **??**, as well as in the numerical exercise we present in Section **??**, we will take this asymmetry into account.

Figure 4
Distribution of s. Top panel: all observations (9,083 observations). Bottom panel: excluding $s = 1$ (5,968 observations). Note that vertical scale is different in bottom panel.



4. Empirical results

Proposition **??** suggest a series of testable predictions. Specifically, we expect r to be increasing in b and decreasing in k and s. Table **??** presents the results from a set of regressions, beginning with our base regression. In all regressions, the dependent variable is a dummy that takes the value 1 when a show is extended into the next season. The regressions differ in terms of functional form. All regressions include fixed effects for the number of episodes, the season number, and the combination of genre and year.

The effect of "IMDb rating", our measure of b, is estimated with statistical precision at 0.035. The sign is consistent with theory. We estimate that a one-standard deviation increase in IMDb rating (which, per Table **??**, is equal to one) is associated with a 3.5% increase in the probability of extension, from a baseline of 69%.

Next we consider the comparative statics with respect to actor talent. The effect of "Talent," our measure of k, is estimated with statistical precision at -0.035. The sign is consistent with theory. We estimate that a one-standard deviation increase in talent quality

Table 3
Season renewal, r, as a function of b, k, and s

Dependent variable:	Renewal after current season (1/0)		
IMDb rating	0.035***	0.034***	0.035***
	(0.01)	(0.01)	(0.01)
Talent quality	-0.035***	-0.036***	-0.035***
	(0.01)	(0.01)	(0.01)
Talent specificity	-0.052**	-0.553***	-0.098***
	(0.02)	(0.18)	(0.03)
Talent specificity squared		0.416***	
		(0.14)	
Talent specificity=1 dummy			0.047*
			(0.02)
Count of episodes f.e.	Yes	Yes	Yes
Season number f.e.	Yes	Yes	Yes
Genre × year f.e.	Yes	Yes	Yes
Adjusted R^2	0.16	0.17	0.16
N. observations	7474	7474	7474
N. clusters	99	99	99

is associated with a decrease in the probability of extension by about 2.6% (.035×0.74).

Finally, the effect of "Talent specificity," our measure of s, is estimated with statistical precision at -0.052. We estimate that a one-standard deviation increase in Top-3 talent specificity is associated with a decrease in the probability of extension by about 1.7% (specifically, .052×0.32).

Our second regression introduces a quadratic term in the variable s. The linear and quadratic terms are statistically significant and have values -0.553 and 0.416, respectively. This implies that the relation between s and r (the probability of continuation) is convex. In fact, since $0.553/(2\times0.416) = 0.66$ lies between zero and 1 (the domain of s), we estimate a total effect that is first negative but positive for high values of s.

At this point one suspects that the non-monotonic relation between s and r may be related to the high density of observations with $s = 1$ (as indicated by Figure **??**). In order to check this possibility, we run a third regression where we add a dummy that takes the value 1 if and only if $s = 1$. We can either add this dummy as a separate regressor or interact it with s: the resulting equation is the same. The coefficients are estimated with precision. They imply that the contribution of s to r increases linearly in s from zero for $s = 0$ to $-.098$ as s tends to 1. At $s = 1$, the contribution of s to r is estimated at $-.098 + .047 = -0.051$. Therefore, this second regression confirms that the effect on s on the likelihood of an agreement is negative for all values of s. We also tried a fourth regression where we combine a quadratic form *and* a dummy for $s = 1$. However, in this case the dummy coefficient is not statistically significant, which suggests that a dummy for

Table 4
Event of no renewal for top-3 actors and subsequent personal career outcomes

Dependent variable:	Number of titles		Average bill order	
	year $t+1$	year $t+2$	year $t+1$	year $t+2$
No renewal$_{i,t}$	0.175***	0.244***	0.067	-0.343***
	(0.01)	(0.01)	(0.10)	(0.10)
Person f.e.	Yes	Yes	Yes	Yes
Year f.e.	Yes	Yes	Yes	Yes
Adjusted R^2	0.30	0.30	0.14	0.14
N. obs.	532968	509536	274975	266493
N. clusters	22921	22410	21196	20784

$s = 1$ or a quadratic functional form are alternative ways of addressing the nonlinearity of the relation between s and r.

■ **Additional predictions.** Although the main focus of our empirical analysis is on the comparative statics with respect to r, our model also has testable implications regarding actor performance. Conditional on a show not being extended, an actor's subsequent performance should be better than average. By "better than average" we mean better than predicted by other controls, in particular actor and year fixed effects. Intuitively, based on our model of failed negotiations, an actor with a better outside option is more likely not to reach an agreement with the producer of an outside TV show, feature film, TV film, or video film. In other words, the sample of actors who have just had their last season with a given show is biased towards actors who, given their favorable outside option, are more likely to reject an offer from producers.

Table **??** displays four regressions that test this prediction. We consider two measures of performance. First, the number of titles (where a titles are distinct TV shows, feature films, TV films, and video films) in which the actor is engaged. Second, his or her (average) bill order in those titles. Note that a *lower* bill order number is a measure of better performance (1 being best), so our theory's prediction corresponds to a positive coefficient on the first performance measure and a negative coefficient on the second measure. We also consider two periods, the year after a show is terminated and the year after that. This results in a total of four regressions.

As can be seen, the results in Table **??** are consistent with theory. The coefficients both on number of shows and billing order are statistically significant for $t + 2$. In that year, an actor present in a recently-terminated show is expected to be present at 0.244 more distinct titles than predicted by actor and year fixed effects, and to be placed 0.343 points higher in the bill order.

■ **Extensions and robustness.** We consider a series of robustness checks that basically extend the set of regressions shown on Table **??**. In particular, since the main variable of focus in our analysis is s, our robustness checks are primarily centered on s.

First, we consider two alternative definitions of s. Recall that our basic definition is

Table 5
Average expected number of seasons according to estimated model, $\mathbb{E}(\widehat{T} \mid T)$, conditional on actual number of seasons, T

T	$\mathbb{E}(\widehat{T}\mid T)$	N
1	2.38	1908
2	3.47	515
3	3.78	226
4	3.95	170
5	4.50	133
6	4.63	92
7	4.96	60
8	4.59	39
9	4.78	33
10	6.68	20

based on the fraction of episodes where a given actor was billed in the top 3. An alternative definition is based on the number of *seasons* in which an actor was billed top 3 in *some* episode during that season. A second alternative definition of s is based on the number of top 3 episode appearances during the *current* season. In both cases, we find our estimates are statistically significant, have the same sign as the estimates in Table **??**, and imply effects of the same order of magnitude.

A second set of robustness tests consists in using the top 5 billed actors in lieu of top 3. We try this alternative approach both for our measure of talent and for our measure of talent specificity. As in the previous robustness tests, we find significant estimates with the same sign and size.

Our basic set of regressions is based on a linear probability model. We also considered Poisson pseudolikelihood estimation. Again, the results are fairly similar.

■ **Model fit.** One way to evaluate the model's fit is to compare the observed duration of each show (number of seasons) with the model prediction based on estimated probabilities of show renewal into the next season. Let T_i be show i's number of seasons. We then compute the model's estimated value of T_i, which we denote by $\widehat{T}_i$, for a given show (conditional on the show having been produced at least one season) as

$$\widehat{T}_i = \sum_{t=1}^{\infty} t\,(1 - r_{it})\,\Pi_{\tau=1}^{t} r_{i\tau}$$

where r_{it} is the probability that show i is renewed after season t. Note that, in some cases, we do not observe some of the show's variables for a given season. When that is the case, we estimate the value of r_{it} by using the nearest estimate of those variables. Having all of the values of r_{it}, we compute $\widehat{T}_i$ for each show i. Finally, for each *observed* show duration, we compute $\mathbb{E}(\widehat{T} \mid T)$, the average value of all $\widehat{T}$ of shows that lasted for T seasons.

Table **??** shows the result of this exercise. The model does a good job at predicting

Table 6
Lower-bound estimate of the probability of inefficient bargaining breakdown, assuming no bargaining inefficiency when $s = 0$

model	prob (%)
linear	3.75
quadratic	13.85
linear with a dummy at $s = 1$	5.30

when shows are expected to last for longer seasons. That said, the relation between T and $\mathbb{E}(\widehat{T} \mid T)$ is flatter than the diagonal.

5. Bargaining inefficiency

Proposition **??** states that, *under efficient bargaining*, an increase in s leads to a higher probability that an agreement is reached. In fact, the joint value of not extending a show declines, whereas the value of extending the show remains constant. By contrast, Proposition **??** provides sufficient conditions such that, *in equilibrium* with asymmetric information, an inefficient breakdown in negotiations takes place with positive probability and moreover a probability that is increasing in s.

Our empirical analysis shows that the probability of a show's continuation is decreasing in s. The relation is statistically significant, robust to a variety of changes in regression specification, and economically sizable. Altogether, we suggest that our theoretical and empirical analyses add up to strong evidence that the efficient bargaining model fails to capture an important feature of reality.

As mentioned earlier, we cannot determine whether it would be efficient for a specific show to be extended. As such, we are unable to distinguish an efficient show termination from an inefficient one. We can, however, provide a lower bound on the extent of inefficient bargaining. Suppose that, when $s = 0$, there is no inefficient bargaining breakdown. This does not follow from the theoretical model, that is, even when $s = 0$ inefficient breakdown takes place with positive probability. However, it allows us to assign to inefficient bargaining any *increase* in the probability of breakdown resulting form *higher* values of s. In fact, as per Proposition **??**, under efficient bargaining, higher values of s should be associated with higher probabilities of a negotiated agreement.

This suggests a strategy for placing a lower bound on the extent of inefficient negotiations failure. We proceed as follows. For each show-season observation, we compute the increase in the probability of a negotiations breakdown in excess of what it would be if $s = 0$. We then average this over all show-season observations. We repeat this process by considering the three regressions in Table **??**: linear, quadratic, and linear with a dummy at $s = 1$.

Table **??** displays the results from this exercise. We note that our estimate based on a quadratic model is significantly higher than those based on linear models. We believe the reason for this is that our exercise amounts to a significant degree of out-of-sample prediction. This is particularly dangerous when we use a quadratic equation. In other words, our quadratic model implies that, as s tends to zero, the probability of an agreement increases at an increasing rate. However, we have very few observations for low values of s,

Table 7
Lower-bound estimate of the probability of inefficient bargaining breakdown, considering a one-standard-deviation increase in s

model	prob (%)
linear	1.72
quadratic	3.15
linear with a dummy at $s = 1$	3.23

and so such an estimate has to be taken with a grain a salt.

Excluding the estimate based on the quadratic model, we obtain a lower bound of the order of 4 percent. We believe this value is sufficiently high to make us take seriously the possibility of inefficient bargaining.

As mentioned in the previous paragraphs, the lower-bound estimates in Table **??** may be criticized by being unrealistically based on "out of sample" extrapolation. We compare the actual values of s with a counterfactual where $s = 0$. However, as Table **??** suggests, $s = 0$ is two or three (or more) standard deviations away from the mean. A more conservative lower bound might be obtained by simply considering a one-standard-deviation increase in the value of s around its mean and assuming that, at the lower end of that shift, the probability of inefficient bargaining breakdown is zero.

Table **??** displays the results from this exercise, again for the three models in Table **??**. Not surprisingly, the values are lower. We also note that the three models now imply similar estimates, which is consistent with the out-of-sample extrapolation story. That said, we still get a lower bound of about 2 percent.

The existence and importance of bargaining inefficiency is likely to depend on the particular context. **?**, arguably the closest paper to ours, estimates that "over one-half of failed negotiations are cases where gains from trade exist." This is one order of magnitude greater than our estimate, but we note that our estimate is a lower bound, not a point estimate.

6. Conclusion

Much of the recent structural empirical IO literature assumes efficient bargaining. Evidence from several industries, including TV shows, suggests that the negotiations outcome is not always efficient. We propose a theoretical model and an identification strategy that allow us to place a 3% lower bound on the probability that a TV show is cancelled even though it would be efficient for it to continue.

One possible next step in this line of research would be to devise and estimate a structural model of show renewal. One advantage of such model is that it would allows us to obtain an estimate of the probability of bargaining breakdown as well as to perform a welfare analysis.

Appendix

Proof of Lemma ??: Consider the case when a makes an offer. The offer is accepted if and only if

$$\epsilon_p < s\,b + k - w_a$$

which by (??) is equivalent to

$$\epsilon_p < x_a$$

So, the offer is accepted with probability $F(x_a)$. The value of x_a is implicitly given by

$$H(x_a) = -x_a + \frac{s\,b - \epsilon_a}{\sigma_p} \tag{18}$$

We cannot, in general, obtain an explicit expression for x_a (it appears on both sides of the equation). However, we can state that the solution is unique. In fact, since H is strictly increasing, the left-hand side of (??) is strictly increasing in x_a. The right-hand side of (??) is strictly decreasing in x_a. At $x_a = 0$, the left-hand side is equal to zero, whereas the right-hand side is positive, since $\epsilon_a < s\,b$. Finally, by the intermediate value theorem, there exists a unique $x_a > 0$ satisfying (??). A similar argument applies in the case when p makes an offer. ■

Proof of Proposition ??: By the implicit function theorem, (??) and (??) imply that

$$\frac{d x_a}{d b} = \frac{s/\sigma_p}{1 + H'(x_a)} > 0$$
$$\frac{d x_p}{d b} = \frac{s/\sigma_a}{1 + H'(x_a)} > 0$$

Since $T(k, s)$ does not depend on b, from (??) we conclude that r is increasing in b.

Suppose now that $\sigma_a = 0$. This implies that, were p to make the TIOLI offer, she would choose $w_p = k$, and the offer is accepted. It follows that $r_p = 1$ if $\epsilon_p < s\,b$ and $r_p = 0$ if $\epsilon_p > s\,b$. If the actor gets to make the TIOLI offer he will demand $w_a > k$ (for the same reason that a monopolist optimally sets price strictly about marginal cost). This implies that $r_a < r_p$. If fact, if $\epsilon_p < s\,b$, then $r_a < 1$ whereas $r_p = 1$; and if $\epsilon_p < s\,b$, then $r_a = r_b = 0$. Now, a change in k affects T but not r_a or r_p. It follows that

$$\frac{d r}{d k} = \frac{d T(k, s)}{d k}\,\big(r_a - r_p\big)$$

Since $dT(k, s)/dk > 0$ and $r_a < r_p$, it follows that $dr/dk < 0$.

When it comes to the comparative statics with respect to s, we also need to worry about the effect of s on r_a and r_p. In both cases, the derivative is positive and proportional to b. It follows that, if $b = 0$, then there is no effect on r_a and r_p. Since $T(k, s)$ is increasing in s (by assumption), the same argument applies as in the case of k. ■

Proof of Proposition ??: An agreement is the efficient outcome if and only if

$$s\,b > \epsilon^a + \epsilon^p$$

The right-hand side is independent of s. Therefore, an increase in s increases the probability that the above inequality holds. ■

References

Backus, Matthew, Thomas Blakee, Bradley Larsen, and Steven Tadelis (2020), "Sequential Bargaining in the Field: Evidence from Millions of Online Bargaining Interactions," *The Quarterly Journal of Economics*, 135, 1319–1361.

Bebchuk, Lucian (1984), "Litigation and Settlement under Imperfect Information," *RAND Journal of Economics*, 15, 404–415.

Cabral, Luís (2010), "TV Power Games: *Friends* and *Law & Order*," NYU Stern Case Study.

Crawford, Gregory S. and Ali Yurukoglu (2012), "The Welfare Effects of Bundling in Multichannel Television Markets," *American Economic Review*, 102, 643–85.

Douglas, Madison (2021), "Why Netflix is Canceling 'On My Block' After Season Four," Yahoo.com.

Fudenberg, Drew, David Levine, and Jean Tirole (1987), "Incomplete Information Bargaining with Outside Opportunities," *The Quarterly Journal of Economics*, 102, 37–50.

Goldberg, Lesley (2019), "Netflix's 'On My Block' Stars Score Sizable Pay Raises," Hollywoodreporter.com.

Gowrisankaran, Gautam, Aviv Nevo, and Robert Town (2015), "Mergers When Prices Are Negotiated: Evidence from the Hospital Industry," *American Economic Review*, 105, 172–203.

Grennan, Matthew (2013), "Price Discrimination and Bargaining: Empirical Evidence from Medical Devices," *American Economic Review*, 103, 145–177.

Grennan, Matthew and Ashley Swanson (2020), "Transparency and Negotiated Prices: The Value of Information in Hospital-Supplier Bargaining," *Journal of Political Economy*, 128, 1234 – 1268.

Ho, Kate and Robin S. Lee (2017), "Insurer Competition in Health Care Markets," *Econometrica*, 85, 379–417.

Larsen, Bradley J (2021), "The Efficiency of Real-World Bargaining: Evidence from Wholesale Used-Auto Auctions," *Review of Economic Studies*, 88, 851–882.

Myerson, Roger (1979), "Incentive Compatibility and the Bargaining Problem," *Econometrica*, 47, 61–73.

Myerson, Roger and Mark A. Satterthwaite (1983), "Efficient Mechanisms for Bilateral Trading," *Journal of Economic Theory*, 29, 265–281.

Nalebuff, Barry (1987), "Credible Pretrial Negotiation," *RAND Journal of Economics*, 18, 198–210.

Ravid, S Abraham (1999), "Information, Blockbusters, and Stars: A Study of the Film Industry," *The Journal of Business*, 72, 463–92.

Samuelson, William (1984), “Bargaining under Asymmetric Information,” *Econometrica*, 52, 995–1005.

Sieg, Holger (2000), “Estimating a Bargaining Model with Asymmetric Information: Evidence from Medical Malpractice Disputes,” *Journal of Political Economy*, 108, 1006–1021.

Silveira, Bernardo S. (2017), “Bargaining With Asymmetric Information: An Empirical Study of Plea Negotiations,” *Econometrica*, 85, 419–452.

Zuckerman, Ezra, Tai-Young Kim, Kalinda Ukanwa, and James Von Rittmann (2003), “Robust Identities or Nonentities? Typecasting in the Feature-film Labor Market,” *American Journal of Sociology*, 108, 1018–1074.