

# Does Information about Arbitrators' Win/Loss Ratios Improve Their Accuracy?

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## ABSTRACT

This paper examines how providing litigants with information about arbitrators' win/loss ratios affects arbitrators' incentives in deciding the cases before them in an impartial and unbiased manner. We show that if litigants are informed about arbitrators' past decisions, then arbitrators might want to make an incorrect decision when a correct decision would raise the suspicion that they are biased. Therefore, providing information about arbitrators' past decisions might create adverse incentive effects and reduce the accuracy of arbitration. We compare the accuracy of arbitrators' decisions under different arbitrator selection procedures and discuss the implications for the design of arbitration rules by arbitration and dispute resolution providers and by court-administered arbitration programs.

## 1. INTRODUCTION

An important distinction between private and public dispute resolution mechanisms concerns the way in which the relevant decision maker—arbitrator or adjudicator—is selected. Whereas litigants have little influence over the assignment of a judge to their lawsuit, in arbitration their approval of an arbitrator is often necessary. This paper

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examines the conditions under which private selection of arbitrators would improve the accuracy of arbitration. In particular, we study how informing litigants about arbitrators' past decisions would affect both the selection of arbitrators and arbitrators' incentive to decide the cases before them in an impartial and unbiased manner.

Dispute resolution providers' codes and arbitration rules exhibit significant concern for arbitrator neutrality. In their due-process protocols, all three of the largest American arbitration providers (the American Arbitration Association, Judicial Arbitration and Mediation Services, and the National Arbitration Forum) provide for the neutrality of selected arbitrators (Searle Civil Justice Institute 2009, app. 3). Moreover, review of the qualifications that must be met by arbitrators on these providers' rosters,<sup>1</sup> as well as by arbitrators from other international institutions,<sup>2</sup> reveals that the providers all guarantee that their arbitrators are free from bias and prejudice.

Nevertheless, when litigants can be classified into well-specified and identifiable groups, they might be subject to arbitrator bias. Group identification may result either from the side taken in a dispute (for example, employers versus employees, consumers or suppliers versus sellers, and the like) or from some other group characteristic, such as ethnic origin (Fizel 1996) or gender (Bemmel 1988). The potential for arbitrator bias has sparked a heated debate over the use of mandatory arbitration in various contexts, such as employment disputes, consumer litigation, financial industry disputes, and Internet domain name disputes.<sup>3</sup> The Consumer Financial Protection Bureau in 2012 issued a request for information regarding the scope, methods, and data sources used in conducting a study of predispute arbitration agreements, following the requirement set by section 1028(a) of the Dodd-Frank Wall Street Reform and Consumer Financial Protection Act of 2010 (Pub. L. No. 111-

1. See American Arbitration Association, Qualification Criteria for Admittance to the AAA National Roster of Arbitrators ([http://www.adr.org/aaa/ShowPDF?doc=ADRSTG\\_003878](http://www.adr.org/aaa/ShowPDF?doc=ADRSTG_003878)); Judicial Arbitration and Mediation Services, Arbitrators Ethics Guidelines (<http://www.jamsadr.com/arbitrators-ethics>); and National Arbitration Forum (2006).

2. See International Institute for Conflict Prevention and Resolution, The Code of Ethics for Arbitrators in Commercial Disputes (<http://www.cpradr.org/Resources/ALLCPRArticles/tabid/265/ArticleType/ArticleView/ArticleID/621/Default.aspx>); Swiss Chambers' Arbitration Institution, Swiss Rules of International Arbitration, art. 9–12 ([https://www.swissarbitration.org/sa/download/SRIA\\_English\\_2012.pdf](https://www.swissarbitration.org/sa/download/SRIA_English_2012.pdf)); London Court of International Arbitration, LCIA Arbitration Rules, art. 5.2 ([http://www.lcia.org/Dispute\\_Resolution\\_Services/LCIA\\_Arbitration\\_Rules.aspx](http://www.lcia.org/Dispute_Resolution_Services/LCIA_Arbitration_Rules.aspx)); and Stockholm Chamber of Commerce, Arbitration Rules, art. 14 ([http://www.sccinstitute.com/filearchive/3/32181/Arbitration%20Rules\\_2010\\_eng\\_final.pdf](http://www.sccinstitute.com/filearchive/3/32181/Arbitration%20Rules_2010_eng_final.pdf)).

3. See the literature review in Section 2.

203, 124 Stat. 1376) (Consumer Financial Protection Bureau 2012). Many of the numerous submissions in response to this request have raised the issues of arbitrator bias and uneven win/loss ratios and attributed it to arbitrator selection and the lack of transparency of arbitrator decisions.<sup>4</sup>

The potential for arbitrator bias is most pronounced when one of the parties is a repeat player and the other party is a one-shot player.<sup>5</sup> If the repeat player has some influence over the choice of arbitrator in future disputes in which the repeat player will be involved, then the arbitrator clearly has an incentive to rule in its favor, in the hope of increasing her chances of being hired to decide future disputes that involve the repeat player. Thus, it may seem that the potential for arbitrator bias would be reduced if each party can veto the arbitrator, since an arbitrator who is believed to be biased in favor of one of the litigants would be vetoed by his counterpart. This paper analyzes arbitrator behavior in such symmetric settings and demonstrates the problematic effects of party veto on arbitrators' decisions and bias.

The rules used by arbitration organizations in the selection of arbitrators provide litigants with varying degrees of control over the selection process.<sup>6</sup> Some of the rules used by arbitration providers allow the arbitration provider full discretion in selecting the arbitrator from its roster.<sup>7</sup> Under these rules, the parties cannot veto the arbitrator unless they

4. See Public Citizen et al. comments, which discuss arbitrator selection and comment on the proper measures of win/loss ratios; Citizen Works comments, which discuss arbitrator selection; American Financial Service Association comments, which discuss the problematic aspects of measuring win/loss rates; the National Association of Consumer Advocates comments, which discuss arbitrator selection and transparency of arbitration decisions and advocate examination of win/loss ratios; and the National Employment Lawyers Association comments, which discuss arbitrator selection.

5. For a first discussion of repeat players and one-shot players in litigation, see Galanter (1974).

6. Most arbitration providers allow the parties to structure their own arbitrator selection procedures instead of relying on the provider's default rule. In structuring their selection procedures, the parties are not constrained to procedures that are offered by the provider, and they may also name the arbitrator that would decide their dispute in their arbitration agreement. Yet if the agreement does not name the arbitrator or specify a method for appointing the arbitrator, then the provider's selection rules apply. Since arbitration may be held before a single arbitrator or before a panel of (usually) three arbitrators, the selection mechanism also depends on the form of arbitration to be held. We focus on single-arbitrator selection only.

7. The roster of arbitrators consists of arbitrators who satisfy the provider's requirements and have registered with it. See, for example, rule 52(a) of the American Arbitration Association Expedited Procedures for Commercial Finance Rules, rule R-10 of the American Arbitration Association Insurance Arbitration Rule, article 9(3) of the International Cham-

show good cause for doing so. Other selection procedures allow the parties more control over the selection of arbitrators, either by allowing them to veto an arbitrator without cause or by asking the parties to rank arbitrators according to their preferences.<sup>8</sup>

Similar policy considerations are also relevant for court-administered arbitration programs. Under these programs, litigants are required to participate in mandatory (yet nonbinding) arbitration when they have not contractually agreed to submit their dispute to binding arbitration. In 2009, 28 states and 10 federal districts operated such programs, which allow judges to order parties to participate in nonbinding arbitration (Schmitz 2009). Like consensual arbitration, mandatory arbitration programs also differ in their arbitrator selection rules.<sup>9</sup>

The question is whether litigants should be allowed to veto arbitrators and whether they should be informed about an arbitrator's past win/loss ratio when deciding whether to veto her. To allow litigants meaningful selection, arbitration providers furnish the litigants with information about potential arbitrators' education, professional experience, and qualifications.<sup>10</sup> Yet since arbitration decisions are often confidential, and since the arbitrator usually is not required to explain or justify her decision, the litigants' only information about an arbitrator's prior decisions is often summarized in the arbitrator's win/loss ratio. Moreover, there are usually two types of arbitration: conventional arbitration, in which the arbitrator decides the case as she sees fit, and final-offer arbitration, in which each party submits an offer to the arbitrator, who must then select one of these offers. Clearly, the arbitrator's decision in final-offer arbitration provides no information other than the offer chosen. Some arbitration providers maintain publicly available data on prior

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ber of Commerce Rules of Arbitration, and article 5.5 of the London Court of International Arbitration Rules of Arbitration.

8. Most arbitration providers allow each party to challenge an appointed arbitrator for cause. Such challenges are often decided by the arbitration provider. Here we focus on the possible veto that may be exercised by each party without cause (and thus without being subject to any further review).

9. Consider, for example, California, which allows litigants to veto proposed arbitrators without cause (see Cal. Rules of Court, rule 3.815), as opposed to New York, which mandates random selection of the arbitrator without allowing the parties any veto rights (see N.Y. Comp. Codes R. & Regs. tit. 22, sec. 28.4).

10. See Judicial Arbitration and Mediation Services, Neutrals: Neutral Search Results (<http://www.jamsadr.com/professionals/xpqProfResults.aspx?xpST=ProfessionalResults>).

arbitration decisions.<sup>11</sup> However, contrary to the prescription of some commentators (for example, Hensler 1990), most mandatory arbitration programs do not provide information about arbitrators' past decisions.

It would seem that providing litigants with such information would facilitate better screening of biased arbitrators. However, our analysis demonstrates that although such information may indeed improve the selection of impartial arbitrators, it might nevertheless introduce adverse incentive effects. Since the only way an arbitrator can establish a reputation for being impartial is by avoiding a series of decisions that might seem biased against a specific group, she might want to make an incorrect decision when a correct decision may raise the suspicion that she is biased.

For example, an arbitrator in employment disputes would not want to make too many decisions in favor of employers, because he would then be perceived as prejudiced against employees, who would veto him in the future. The arbitrator would therefore have an incentive to decide some cases against employers, even if he knows these decisions to be wrong.

We analyze two types of cases. The first type of case is one in which arbitrators may be biased against either one of the two identifiable groups. For example, in employment disputes, some arbitrators may be biased against employers, whereas others may be biased against employees. We call this the two-sided bias case. In the second type of case, bias may be against only one identifiable group. This is the case if, for example, the arbitration provider is selected by one party. Since the provider maintains its roster of arbitrators (as distinguished from the specific arbitrator who would decide the case, who may still be chosen

11. Notably, the California Code of Civil Procedure (sec. 1281.96) requires any private arbitration company that administers or is otherwise involved in a consumer arbitration to collect and publish information about each consumer arbitration it handled in the preceding 5 years. See also arbitration decisions reported by various state and private institutions, such as the State of Minnesota Bureau of Mediation services, Arbitration Awards for 2013 ([http://www.bms.state.mn.us/arbitration\\_awards.html](http://www.bms.state.mn.us/arbitration_awards.html)); the Financial Industry Regulatory Authority, FINRA Arbitration Awards Online (<http://finraawardsonline.finra.org/>); the State of Washington's Public Employment Relations Commission, Public Employment Relations Commission (<http://www.perc.wa.gov/intarbaawards.asp>); and international arbitration providers, such as the World Trade Organization, World Trade Organization Arbitrators Decisions (<http://www.worldlii.org/int/cases/WTOARB/>); the International Chamber of Commerce, ICC Dispute Resolution Library (<http://www.iccdri.com/default.asp>), and the International Center for Settlement of Investment Disputes, List of ICSID Cases (<http://icsid.worldbank.org/ICSID/FrontServlet?requestType=CasesRH&actionVal=ListCases>).

by a symmetric veto or a random procedure), it may exclude from this roster any arbitrator who demonstrates a bias against the party that performs the selection, thus leaving only arbitrators who are potentially biased in its favor. We call this a one-sided bias case.

For each case, we compare three possible selection and information regimes. In the No Veto regime, the arbitrator is randomly selected from the roster of arbitrators, and neither litigant may veto the selection. In the Veto + No Information regime, the litigants are offered a list of three randomly selected arbitrators, and each litigant can veto one of them. Under this regime, the litigants do not observe arbitrators' past decisions. The Veto + Information regime is similar to the Veto + No Information regime, but it allows litigants to observe the arbitrators' past decisions. An optimal regime is one that maximizes the probability of accurate and impartial decisions. Our analysis identifies the conditions under which allowing the parties to veto proposed arbitrators and providing them with information about arbitrators' past performance would prove optimal.

Our findings inform the debate about arbitration as an alternative to public adjudication. By analyzing the conditions under which private selection would prove optimal, we delineate the proper boundaries for arbitration. Moreover, our findings have implications for the design of arbitration rules by arbitration providers, by other organizations that rely on arbitration for the resolution of disputes among their members, and by court-ordered arbitration programs. Our results suggest that using win/loss ratios to measure the bias of individual arbitrators may prove problematic. Such measures may have adverse incentive effects over arbitrators' decisions that would make arbitration less accurate. Our results also imply that balanced win/loss ratios may, in fact, represent strategic incorrect decisions by arbitrators. Thus, their value in proving that a certain arbitration mechanism is unbiased is questionable.

The adverse effect on reputation that results from information about past behavior is not unique to arbitration. Prior literature has recognized the adverse effects of a potential bad reputation when only the agents' actions (but not the state of the world) can be publicly observed. In such environments, agents may take actions that they believe to be inferior to avoid adverse inference about their true types, especially when such inference would be followed by social and economic sanctions. This dynamic may constrain free speech and distort expert advice if it is considered politically incorrect (Loury 1994; Morris 2001). It may also distort the actions taken by professionals and experts such as lawyers,

doctors, or car mechanics, who may avoid taking actions that promote their private interests, even if those actions are best for their clients (Ely and Välimäki 2003). In all such circumstances, an agent may paradoxically deviate from the action that maximizes both his client's and his own welfare, only to demonstrate his commitment to pursue the client's interests over his own. This paper applies this general insight to the specific context of arbitration. As we show, in the presence of adverse effects on reputation, information about an arbitrator's past win/loss ratio is not only less informative than it initially seems, but it may also reduce the accuracy of arbitrator decisions.

The paper proceeds as follows. Section 2 reviews previous literature on arbitration selection and incentives. Section 3 presents our model for the behavior of arbitrators who want to establish a reputation for not being biased and also analyzes arbitrator selection and behavior under alternative selection regimes. Section 4 compares the accuracy of arbitration under the three alternative regimes. Sections 3 and 4 focus on cases in which arbitrators may each be biased in favor of the defendant or in favor of the plaintiff. The case in which arbitrators may be biased in favor of only one of the parties (for example, the defendant) is discussed in Section 5. Section 6 concludes. All proofs are relegated to the Appendix.

## 2. PRIOR LITERATURE

Arbitrator bias presents a significant handicap for the effectiveness of arbitration as a dispute resolution mechanism. Therefore, a large part of the legal and economic literature on arbitration has focused on the fairness and neutrality of arbitration outcomes in contexts such as employment arbitration (Sherwyn, Estreicher, and Heise 2005), securities brokerage dispute arbitration (Choi, Fisch, and Pritchard 2008), investment treaty arbitration (Franck 2009), consumer arbitration (Searle Civil Justice Institute 2009), Internet domain name dispute resolution (Geist 2002), and Major League Baseball arbitration (Scully 1978).

The literature generally has tried to measure arbitration bias by analyzing either arbitration awards or arbitrators' win/loss rates.<sup>12</sup> These were studied in two types of cases: one in which one litigant is a repeat

12. Note that under final-offer arbitration, win-loss rates may be misleading. They may be biased because of more conservative offers made by one party compared to the other. See Scully (1987) and Ashenfelter and Bloom (1983).

player and the other is a one-shot player, and the other in which both litigants are either repeat players or one-shot players.

In contexts in which only one of the litigants is a repeat player, it is expected that arbitrators would tend to decide in favor of the repeat player, to be selected again to arbitrate future disputes. Indeed, Tullock (1980, p. 127) asserts that private selection would motivate arbitrators to “choose a decision which is most likely to lead to his being selected for arbitration in the future” (see also Iossa 2007). Tullock conjectures that this may lead arbitrators to bias their decisions in contexts such as consumer arbitration, where one of the parties (the retailer) uses arbitration more often and has better information about potential arbitrators. This conjecture finds some support in empirical research.<sup>13</sup>

When both players are one-shot players, arbitrators are expected to try to avoid being perceived as biased in favor of one of the parties. In such cases, Ashenfelter and Bloom (1984), Ashenfelter (1987), and Ashenfelter and Dahl (2012) report that arbitrators’ decisions exhibit no consistent bias. They explain that arbitrators tend to avoid extreme decisions and decide disputes on the basis of their prediction of how other arbitrators would have decided the case.

Other authors have speculated that arbitrators would tend to split the difference and award each party a partial victory. As Posner (2005, p. 1261) suggests, “[T]his will make it difficult for the parties on either side of the class of suits in question to infer a pattern of favoritism.” However, the evidence for this conjecture is mixed. Farber (1981), for example, finds no such tendency. Bloom (1986) reports behavior that is consistent with splitting the difference but suggests an alternative explanation for his findings. More recent empirical research finds no support for this conjecture (see Keer and Naimark 2001; Searle Civil Justice Institute 2009).

Our model formalizes the reputation effects by using a game-theoretic model that incorporates the decisions of both the arbitrator and the litigants. The model allows us to compare alternative selection and information regimes as well as to examine the welfare effects induced by the combination of selection and incentive effects induced by those regimes and, in particular, by the provision of information about arbitra-

13. Choi, Fisch, and Pritchard (2008) find that control over the selection of arbitrators increases arbitrators’ incentives to cater to the interests of brokers, who are repeat players in securities brokerage disputes. See also Kondo (2009).



tors' win/loss ratios. Unlike in previous literature, our model examines how arbitrators' decisions depend on previous decisions they have made.

### 3. A MODEL OF ARBITRATOR INCENTIVES AND BIAS

A dispute involves two litigants. For convenience, litigants are identified as Plaintiff and Defendant. In practice, identification of the parties may of course be independent of their procedural roles as plaintiff or defendant, as for example in the case of disputes between employers and employees, where the suit may be filed by either side. We therefore use the plaintiff and defendant identification for convenience only.

Every dispute has a correct decision in which the defendant is either liable or not. We assume that the defendant is liable with probability  $p$ . That is, the defendant and plaintiff each believe themselves—as well as other defendants and plaintiffs—to be right (or to be able to win the case if it is decided in an impartial manner), with probabilities  $1 - p$  and  $p$ , respectively. To simplify the analysis, we consider the symmetric case in which  $p \equiv \frac{1}{2}$ . Each litigant obtains a payoff of 1 if it wins the dispute and  $-1$  if it loses.

An arbitrator is assumed to live for 2 periods and may arbitrate, at most, two different disputes, one in each period (an arbitrator need not be employed in every period in which she lives). An arbitrator can be either strategic or nonstrategic. If she is nonstrategic, then she may be either pro-defendant or pro-plaintiff. A pro-defendant arbitrator always decides in favor of the defendant, and a pro-plaintiff arbitrator always decides in favor of the plaintiff, independent of the correct decision or the arbitrator's prospects of being employed in the future.<sup>14</sup> In contrast, a strategic arbitrator decides the cases before her so as to maximize the sum of her lifetime payoffs:<sup>15</sup> she obtains a payoff of  $b > 0$  each time she is employed, and on top of that she obtains a payoff of 1 each time she decides correctly and a payoff of 0 each time she decides incorrectly (strategic arbitrators are assumed to know the correct decision in the case before them). Thus, a strategic arbitrator prefers to deliver a correct decision, yet she also cares about her monetary fee. Observe that on

14. In a more general model, biased arbitrators may also behave strategically. Our results would continue to hold in this case, as long as biased arbitrators still behave in a way that is more biased than unbiased strategic arbitrators, so that the posterior belief after a decision in favor of the party she is suspected to favor puts a larger weight on the arbitrator being biased in this direction.

15. For simplicity, we assume that arbitrators do not discount their future payoffs. This assumption has no effect on our results.

being employed for the first time and thus securing a payoff of  $b$ , an (inexperienced) strategic arbitrator prefers to make a wrong decision followed by a correct decision, which would generate an additional payoff of  $1 + b$ , than to make just one correct decision, which would generate an additional payoff of 1. Thus, whereas a nonstrategic arbitrator is always biased, a strategic arbitrator may choose to make an incorrect decision if she believes that it will improve her chances to be employed again in the next period.

In this section and in Section 4, we analyze the two-sided case in which arbitrators may each be biased in favor of the defendant or in favor of the plaintiff. We assume that a measure 1 of young arbitrators appears in every period. Half of the young arbitrators are believed to be pro-defendant with probability  $\beta_D$  and strategic with probability  $1 - \beta_D$ , and the other half are believed to be pro-plaintiff with probability  $\beta_P$  and strategic with probability  $1 - \beta_P$ , where  $\beta_D$  and  $\beta_P$  are distributed according to a continuous cumulative distribution function  $F$  on the unit interval.

It is useful to denote an arbitrator's type more simply by just  $\beta \in [-1, 1]$ , with the understanding that if  $\beta > 0$ , then  $\beta$  denotes the probability that the arbitrator is pro-defendant, and if  $\beta < 0$ , then  $-\beta$  denotes the probability that the arbitrator is pro-plaintiff. We denote the cumulative distribution of  $\beta \in [-1, 1]$  by  $\hat{F}$ .<sup>16</sup> Note that the fact that  $\beta_D$  and  $\beta_P$  are both distributed according to  $F$  implies that the density function of  $\beta$  is symmetric around zero.<sup>17</sup>

We assume that the parties may not settle the case. This would be the case if defendants and plaintiffs each believe that the distribution  $\hat{F}$  is slightly biased in their favor.

In Section 5, we discuss the case of one-sided bias, where all the arbitrators are suspected of being pro-defendant with probability  $\beta_D$  and

16. Thus,

$$\hat{F}(\beta) = \begin{cases} \frac{1}{2} + \frac{F(\beta)}{2} & \text{if } \beta > 0 \\ \frac{1}{2} - \frac{F(-\beta)}{2} & \text{if } \beta \leq 0. \end{cases}$$

17. It should be noted that assuming instead that  $p \neq \frac{1}{2}$  or that the distribution of arbitrators' types is not symmetric around zero would complicate the model because it would require separate analysis of the cases in which  $\beta$  is positive and negative. The assumption of symmetry simplifies the analysis because it implies that the cases of a positive and negative  $\beta$  are mirror images of each other. It has no other qualitative effect on our results.

strategic with probability  $1 - \beta_D$  and where  $\beta_D$  is distributed according to a continuous cumulative distribution function  $F$  on the unit interval. In this case, the cumulative distribution of arbitrators' types is  $\hat{F}(\beta) = F(\beta)$  for every  $\beta$ . We compare the results under such distribution with the case of two-sided bias.

As explained in the Introduction, we consider three veto and information regimes: No Veto, Veto + Unobservable Information, and Veto + Observable Information. In every period, one or more pairs of litigants appear. Depending on the applicable regime, the litigants are assigned either an arbitrator or a panel of three arbitrators from which one arbitrator is selected. Thus, each regime induces a game between the litigants and the arbitrators. We focus on the symmetric stationary pure-strategy perfect Bayesian equilibria of this game.

### 3.1. No Veto Regime

Consider first the simple regime in which litigants are offered an arbitrator who is chosen randomly from the roster of arbitrators. Thus, a plaintiff-defendant pair is assigned an arbitrator whose type is equally likely to be either  $\beta_D$  or  $\beta_P$ , where  $\beta_D$  and  $\beta_P$  are distributed according to  $F$  on the unit interval. Neither litigant can veto the proposed arbitrator. The arbitrator decides the case. Then another plaintiff-defendant pair is assigned an arbitrator, and so on.

The No Veto regime induces a trivial game with litigants and arbitrators as players. Under this regime, there is no screening of arbitrators. Thus, biased (pro-plaintiff and pro-defendant) arbitrators decide according to their bias, and strategic arbitrators decide correctly because they have nothing to gain from deciding otherwise.

### 3.2. Veto with Unobservable Information Regime

Consider now a regime in which litigants are offered a list of three arbitrators from which they may each veto one arbitrator at most. The remaining arbitrator decides the case.<sup>18</sup>

As in the No Veto regime, this Veto + Unobservable Information regime also induces a game with the litigants and arbitrators as players. In this game, the litigants each decide which arbitrator to veto on the basis of their prior beliefs about the arbitrators' types, and the remaining arbitrator renders a decision.

18. If more than one arbitrator is not vetoed, then the arbitrator is chosen randomly from those who were not vetoed.

The arbitrators' behavior in equilibrium is the same as under the No Veto regime. Namely, if employed, biased arbitrators decide according to their bias, and strategic arbitrators decide correctly. As in the No Veto regime, the fact that arbitrators' decisions are unobservable implies that strategic arbitrators have nothing to gain from deciding incorrectly. However, under this regime, arbitrators with high values of  $|\beta|$ , who are more likely to be biased, are also more likely to be vetoed and screened out.

To see this, observe that the expected payoff to the defendant from an arbitrator of type  $\beta \in [-1, 1]$  is

$$\beta + (1 - \beta)(1 - 2p) = 1 - 2p + 2p\beta,$$

and the expected payoff to the plaintiff from an arbitrator of type  $\beta \in [-1, 1]$  is

$$-\beta + (1 - \beta)(1 - 2p) = 1 - 2p - 2\beta + 2\beta p.$$

The former function is increasing and the latter function is decreasing in  $\beta$ . Hence, when allowed to veto one arbitrator from a panel of three possible arbitrators, the defendant vetoes the arbitrator with the smallest  $\beta$ , and the plaintiff vetoes the arbitrator with the highest  $\beta$ . Thus, under the Veto + Unobservable Information regime, in any equilibrium of the game, the arbitrator with the intermediate value of  $\beta$  in the panel of three arbitrators is selected to decide the dispute.

Furthermore, as mentioned above

**Proposition 1.** Under the Veto + Unobservable Information regime, in any equilibrium of the game the probability that an arbitrator of type  $\beta$  is vetoed is increasing in  $|\beta|$ .<sup>19</sup>

By intuition, we see that the fact that arbitrators with the middle value of  $\beta$  are selected from each panel of arbitrators already suggests that arbitrators with extreme values of  $\beta$  would be less likely to be selected. A little more formally, notice that an arbitrator is selected from a panel if one of the other two arbitrators on the panel has a lower  $\beta$  and the other has a higher  $\beta$ . The probability of this is given by the function

$$2\hat{F}(\beta)[1 - \hat{F}(\beta)],$$

which is increasing in the interval  $[-1, 0]$  and decreasing in the interval  $[0, 1]$ .

19. This result is independent of the value of  $p$ .

### 3.3. Veto with Observable Information Regime

The third regime that we consider is similar to the regime described in Section 3.2, except that under this Veto + Observable Information regime, litigants are informed about arbitrators' past decisions. This information allows the litigants to refine their beliefs about arbitrators' types on the basis of their past decisions.

As in Section 3.2, this Veto + Observable Information regime induces a game with the litigants and arbitrators as players. In this game, the litigants each decide which arbitrator to veto based on their prior beliefs about the arbitrator and the arbitrator's past decisions. The remaining arbitrator renders a decision.

In this regime, it is important to distinguish between old arbitrators for whom this would be the last decision and young arbitrators who may be called to arbitrate yet another dispute. Old arbitrators may be either experienced or inexperienced, depending on whether they arbitrated a dispute when they were young. We assume that arbitrators are randomly selected for panels. In particular, old and young arbitrators have the same probability of being selected to appear on any panel. Without loss of generality, this probability may be normalized to one.

It is important to emphasize that whereas old strategic arbitrators cannot do better than decide correctly, young strategic arbitrators may bias their decisions to increase the probability that they will be employed again. This reputation-driven bias gives rise to the equilibrium below.

**Proposition 2.** Under the Veto + Observable Information regime, there exists a threshold value  $\bar{\beta}(b) \in [0, 1]$  such that young strategic arbitrators with types  $|\beta| \leq \bar{\beta}(b)$  decide correctly and young strategic arbitrators with types  $|\beta| > \bar{\beta}(b)$  decide against their suspected bias. Old strategic arbitrators decide correctly. The threshold  $\bar{\beta}(b)$  is decreasing in  $b$ . It is equal to one if  $b$  is sufficiently small, and it is equal to zero if  $b$  is sufficiently large.<sup>20</sup>

Proposition 2 stands in contrast to the perceived wisdom that arbitrators' concern for reputation would motivate them to deliver more accurate decisions. Here some arbitrators decide incorrectly because they want to demonstrate that they are unbiased. Their incentive to avoid a

20. A value of  $p \neq \frac{1}{2}$  (and no symmetry of the distribution around zero) implies that instead of just one threshold, there would be two different thresholds: one for arbitrators who are suspected of being pro-plaintiff and one for arbitrators who are suspected of being pro-defendant. All other results in this section remain unchanged.

bad reputation induces them to deliver incorrect decisions. Moreover, as the arbitrators' fee increases, more arbitrators are induced to deliver incorrect decisions.

Furthermore, the fact that young strategic arbitrators may decide against their suspected bias, independent of the correct decision, implies that the litigants would not necessarily veto the arbitrator with the smallest or largest  $\beta$ , as they do under the Veto + Unobservable Information regime. The middle type is not necessarily the one who would be chosen to arbitrate.

For example, the defendant is indifferent between an arbitrator  $\beta$ , who decides correctly if strategic, and an arbitrator  $\hat{\beta} = 1 - p + p\beta > \beta$ , who decides against the defendant if strategic.<sup>21</sup> This implies that the defendant prefers arbitrator  $\beta < \hat{\beta}(b)$  to any arbitrator  $\beta'$  that satisfies  $\hat{\beta}(b) < \beta' < \hat{\beta}$  and therefore decides against the defendant if she is strategic. If the panel consists of the following three types:  $\beta$ ,  $\beta'$ , and  $\beta'' = 1$ , then the plaintiff would veto  $\beta''$ , and the defendant would veto  $\beta'$ . Therefore,  $\beta$ , who has the lowest type, would be chosen to arbitrate the dispute.<sup>22</sup>

#### 4. THE OPTIMAL ARBITRATOR SELECTION REGIME

As explained in the Introduction, we measure the welfare that is associated with each veto and information regime by the probability that the selected arbitrator renders a correct decision in equilibrium. This is the welfare measure that would be of interest to policy makers or prospective litigants who wish to maximize their total welfare. We compare the three selection regimes according to their induced probability of a correct arbitrator's decision.

The analysis in Section 3 implies that the relative accuracy of the three regimes depends on the relative strength of the following two effects: the selection effect, which refers to the fact that the availability of information about arbitrators' past decisions facilitates the selection of experienced impartial arbitrators; the incentive effect, which refers to the fact that the provision of information may cause young strategic arbitrators to decide incorrectly to avoid a reputation for being biased.

21. The expected payoff that arbitrators  $\beta$  and  $\hat{\beta}$  generate to the defendant are  $\beta + (1 - \beta)(1 - 2p)$  and  $\hat{\beta} - (1 - \hat{\beta})$ , respectively. These two functions have equal values if  $\hat{\beta} = 1 - p + p\beta$ .

22. Examples in which the largest type is chosen can also be easily constructed.

We first compare the No Veto and Veto + Unobservable Information regimes.

**Proposition 3.** The expected probability of a correct decision under the Veto + Unobservable Information regime is higher than under the No Veto regime.<sup>23</sup>

By proposition 1, under the Veto + Unobservable Information regime, the probability that an arbitrator is vetoed increases in her probability of being biased,  $|\beta|$ . This implies that the Veto + Unobservable Information regime induces a better selection of arbitrators and therefore generates a higher probability of a correct decision, compared to the random selection under the No Veto regime. Since the Veto + Unobservable Information regime generates no negative incentive effect, proposition 3 immediately follows.

The question is whether also giving litigants information about arbitrators' past decisions, in addition to allowing them veto rights over arbitrators, would further increase the probability of a correct decision. As mentioned above, in the context of the Veto + Observable Information regime, we assume that each arbitrator, young or old, has an equal chance of being selected to appear in a panel of three arbitrators from which the arbitrator who is chosen to decide a dispute is selected, regardless of his or her type or history.<sup>24</sup>

**Proposition 4.** If  $b$  is small, then the Veto + Observable Information regime generates a higher probability of a correct decision than the Veto + Unobservable Information regime.<sup>25</sup>

The intuition for this result is the following. If  $b$  is sufficiently small, then according to proposition 2, almost all young strategic arbitrators decide correctly under the Veto + Observable Information regime, and therefore arbitrators behave almost identically under the two regimes,

23. This result is independent of the value of  $p$ .

24. If old arbitrators have a much higher chance of being selected for panels than young arbitrators, then almost all old arbitrators would be inexperienced, and the probability of a correct decision under the two regimes would be very similar. If young arbitrators have a much higher chance of being selected for panels than old arbitrators, then young arbitrators will not expect to be chosen again and thus will decide correctly if strategic. Again, the probability of a correct decision under the two regimes would be very similar.

25. Propositions 4 and 5 rely on the equilibrium described in proposition 2, and so the analysis is obviously affected by the value of  $p$ . Note, however, that the statements of propositions 4 and 5 are qualitative in nature and refer to small  $b$  or large  $b$ , respectively. Hence, the statements of propositions 4 and 5 continue to hold for any value of  $p$  that is different from zero or one.

which implies that the Veto + Observable Information regime generates no adverse incentive effect. This implies that the superior selection that is afforded by the Veto + Observable Information regime generates a higher probability of a correct decision.

If, on the other hand,  $b$  is sufficiently large, then the reputation effect implies that most of the young strategic arbitrators decide incorrectly, which reduces welfare but identifies them as unbiased and therefore improves overall selection. The question is whether this improved selection is enough to compensate for the adverse incentive effect. The answer to this question depends on the exact distribution of arbitrators' types. Proposition 5 shows that there are cases where the negative incentive effect is stronger than the positive selection effect, thus rendering information about past decisions undesirable.

**Proposition 5.** Suppose that the distribution of arbitrators' types  $F$  is concentrated on a single type  $\beta_0$  and that  $b$  is so large that all young strategic arbitrators decide against their suspected bias under the Veto + Observable Information regime (proposition 2). Then the probability of a correct decision is strictly higher under the Veto + Unobservable Information regime than under the Veto + Observable Information regime for any value of  $\beta_0 \in (0, 1)$ .

## 5. ONE-SIDED BIAS

Suppose now that the cumulative distribution of arbitrators' types  $\hat{F}(\beta)$  is one-sided. For concreteness, suppose that all the arbitrators are suspected of being pro-defendant with probability  $\beta_D$  and strategic with probability  $1 - \beta_D$ , and suppose that  $\beta_D$  is distributed according to a continuous cumulative distribution function  $F$  on the unit interval.

In this case, unless only the discriminated party is allowed to veto arbitrators, any selection mechanism would result in biased decisions. The equilibria under the No Veto and the Veto + Unobservable Information regimes are qualitatively unchanged. Thus, the probability of a correct decision under the No Veto regime is given by the expectation of  $\beta$ . Under the Veto + Unobservable Information regime, the arbitrator with the intermediate value of  $\beta$  is still selected from each panel of three arbitrators to decide every dispute. This implies that arbitrators with intermediate values of  $\beta$  are selected to decide disputes, and therefore the probability of a correct decision is equal to the expectation of intermediate  $\beta$  values from panels that consist of three independently



drawn  $\beta$ 's. A well-known result in the theory of order statistics (David and Nagaraja 2003) implies that the expectation of the intermediate  $\beta$  value is equal to the median of the distribution  $\hat{F}$ . Thus, we have the following result

**Proposition 6.** Under one-sided bias, if the median of  $\hat{F}$  is smaller (larger) than the expectation of  $\hat{F}$ , then the Veto + Unobservable Information regime generates a higher (lower) probability of a correct decision than the No Veto regime.

By intuition, we see that if the median of  $\hat{F}$  is smaller than the expectation of  $\hat{F}$ , as would be the case for example if  $\hat{F}$  is concave, then most arbitrators have small  $\beta$  values. In this case, the Veto + Unobservable Information regime is superior to the No Veto regime because it allows the litigants to veto arbitrators with high  $\beta$  values who are biased with a high probability. If, on the other hand, the median of  $\hat{F}$  is larger than the expectation of  $\hat{F}$ , as would be the case if, for example,  $\hat{F}$  is convex, then most arbitrators have large  $\beta$  values. In this case, the Veto + Unobservable Information regime is inferior because it allows the litigants to veto arbitrators with small  $\beta$  values who are more likely to be unbiased.

Under one-sided bias, informing the parties about arbitrators' win/loss ratios becomes less attractive than it was under two-sided bias. Under one-sided bias, being identified as unbiased generally reduces the probability of being selected to decide future disputes, because unbiased arbitrators are more likely to be vetoed by the defendant. Therefore, the availability of more information does not induce a positive selection effect, as in the two-sided case. When  $b$  is small and arbitrators behave identically under both veto regimes, there is no difference between them. However, as  $b$  increases, the concern of young strategic arbitrators about possible bad reputation under the Veto + Observable Information regime causes them to distort their decisions. Consequently, the overall probability of a correct decision decreases.

## 6. CONCLUSION

It is often suggested that allowing litigants to select their arbitrators renders arbitration more accurate. Compared to judges, whose career concerns do not depend on the litigants' perceptions about their possible bias, arbitrators want to increase their chances of being selected to decide future disputes and therefore want to acquire a good reputation for being

unbiased.<sup>26</sup> However, in some circumstances, such as those described in this paper, reputation may also have adverse effects, because arbitrators may decide incorrectly to avoid acquiring a bad reputation.

Previous literature has questioned arbitrator neutrality in contexts in which the arbitrator is selected by one of the parties who is a repeat player in arbitration. This paper demonstrates the problematic aspects of private selection of arbitrators in symmetric settings.

As we demonstrated, arbitrators' incentive to maintain a balanced win/loss ratio so as to dispel any suspicion of bias might motivate them to deliver less accurate decisions. Indeed, win/loss ratios provide very limited and truncated information. They do not allow litigants to examine the accuracy of arbitrators' past decisions. If such accuracy could be observed, then information would prove unequivocally beneficial, and it would result in better selection and incentive effects. Unfortunately, information about the accuracy of an arbitrator's decision is hardly ever available, especially absent any appeal over it.

Reputation also has positive incentive effects, as biased arbitrators try to acquire good reputations. If policy makers—either in contractual or in mandatory arbitration—can control the arbitrator's fee, then setting it low would prevent a bad reputation but would also weaken the incentive to acquire a good reputation, which we have not modeled in this paper. Conversely, setting a high arbitrator fee would strengthen the incentive to acquire both good and bad reputations.

Thus, a wise choice of the arbitrators' fees has to depend on whether the population of arbitrators consists mostly of unbiased or biased arbitrators. If arbitrators are mostly unbiased, then the main problem that faces policy makers is how to ensure that arbitrators are not subject to bad-reputation problems that cause them to distort their decisions. As shown above, the best that policy makers can do under such circumstances is to set the fee as low as possible and employ a Veto + Observable Information regime. If, however, arbitrators are mostly biased, then the main problem is good reputation—or how to encourage biased arbitrators to appear unbiased. The classic results of the literature on reputation suggest that in such cases it is best to set a high fee and, again, to employ a Veto + Observable Information regime.<sup>27</sup>

26. The classical references for the positive effects of reputation are Kreps and Wilson (1982) and Milgrom and Roberts (1982).

27. A referee has drawn our attention to the fact that if certain arbitrators are known to specialize in less important disputes (with low  $b$  values) while others specialize in more

Finally, there are contexts in which arbitrators may feature one-sided bias in favor of one party only. Then, random selection, as in the No Veto regime, may result in more accurate decisions compared to private selection under a Veto regime. This would be the case if the probability of bias is high for most arbitrators and therefore the median probability that an arbitrator is biased is higher than the mean. Conversely, if most arbitrators are likely to be unbiased and the median is smaller than the mean, then private selection would prove more desirable.

## APPENDIX: PROOFS

### Proof of Proposition 1

We compute the probability that an arbitrator of type  $\beta \in [-1, 1]$  is employed under the Veto + Unobservable Information regime. Given three different arbitrators' types  $\beta_0 < \beta_1 < \beta_2$ , the plaintiff would veto arbitrator  $\beta_2$ , the defendant would veto arbitrator  $\beta_0$ , and so arbitrator  $\beta_1$  would be employed. For a given  $\beta$ , the probability that out of two other  $\beta$  values there is exactly one  $\beta$  that is smaller and one  $\beta$  that is larger is<sup>28</sup>

$$P(\beta) = 2\hat{F}(\beta)[1 - \hat{F}(\beta)].$$

For any monotone function  $\hat{F}$ , the probability  $P(\beta)$  is increasing for  $-1 \leq \beta < 0$ , decreasing for  $0 \leq \beta \leq 1$ , and maximized at  $\beta = 0$ , where it equals  $\frac{1}{2}$ . Q.E.D.

### Proof of Proposition 2

Denote the probability that an arbitrator with type  $\beta$  who is believed to decide correctly if strategic is employed in equilibrium by  $P^l(\beta)$ . The proof consists of two parts. First, we show that if the probability  $P^l(\beta)$  is increasing on the interval  $[-1, 0]$  and decreasing on the interval  $[0, 1]$  with a discontinuous jump at  $P^l(0)$ , then arbitrators' equilibrium strategies are as described in the statement of the proposition. Second, we show that if arbitrators' strategies are as described in the statement

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important disputes (with high  $b$  values), then it may be advisable to provide information about the decisions of the former but not the latter, provided, of course, that arbitrators indeed specialize in this way and can be recognized as such by the appropriate regulatory bodies.

28. The fact that  $F$  is continuous implies that the probability of a tie is zero and so can be ignored.

of proposition 2, then the probability  $P^l(\beta)$  has the properties described above.

Suppose that probability  $P^l(\beta)$  is increasing on the interval  $[-1, 0]$  and decreasing on the interval  $[0, 1]$  with a discontinuous jump at  $P^l(0)$ . Consider the situation of an inexperienced strategic arbitrator  $\beta \in (0, 1)$  who is suspected of being pro-defendant and who is believed to decide in favor of the plaintiff with a positive probability  $\rho > 0$ .<sup>29</sup> The posterior belief about this arbitrator if she decides in favor of the plaintiff is

$$\beta' = 0,$$

and the posterior belief about this arbitrator if she decides in favor of the defendant is

$$\beta'' = \frac{\beta}{\beta + (1 - \beta)(1 - \rho)}.$$

If arbitrator  $\beta$  realizes that the plaintiff is right, then the fact that the probability  $P^l$  is decreasing implies that she cannot do better than to decide in favor of the plaintiff, because this would increase both her payoff from making the correct decision and the probability of being employed again. However, if the defendant is right, then the payoff to the arbitrator if she decides in favor of the defendant is

$$1 + b + P^l(\beta'')(1 + b),$$

and her payoff if she decides in favor of the plaintiff is

$$b + P^l(0)(1 + b).$$

The arbitrator would therefore decide correctly in favor of the defendant if and only if

$$1 + b + P^l(\beta'')(1 + b) \geq b + P^l(0)(1 + b)$$

and

$$P^l(\beta'') \geq P^l(0) - \frac{1}{1 + b}.$$

This inequality defines a threshold  $\bar{\beta}$  such that arbitrators with small types  $\beta \leq \bar{\beta}$  decide correctly and arbitrators with large types  $\beta > \bar{\beta}$  decide in favor of the plaintiff. If  $b$  is small, then  $P^l(0) - [1/(1 + b)] < 0$ , and

29. In any reasonable equilibrium, a decision of an arbitrator who is suspected of being pro-defendant in favor of the plaintiff would be interpreted as a signal that the arbitrator is unbiased. Thus, for an inexperienced strategic arbitrator who is suspected of being pro-defendant to always decide in favor of the defendant cannot be part of a reasonable equilibrium.

thus every arbitrator type would decide correctly. If  $b$  is large enough, then the discontinuity of the probability function  $P^I$  at zero implies that

$$P^I(\beta'') < P^I(0)$$

for every  $\beta'' > 0$ , and therefore all strategic inexperienced arbitrators with  $\beta > 0$  always decide in favor of the plaintiff.

We now show that if arbitrators' strategies are as described in the statement of the proposition, then the probability  $P^I$  has the properties described above. Denote the cumulative distribution function of young and old arbitrators' types by  $F^Y$  and  $F^O$ , respectively. Observe that  $F^Y = \hat{F}$  is continuous. The fact that inexperienced strategic arbitrators' decisions may reveal themselves to be unbiased implies that  $F^O$  contains a mass point at zero. Recall that we assume that young and old arbitrators have an equal chance to be selected for the list of three arbitrators from which litigants choose the arbitrator who will ultimately decide their dispute.

We show that  $P^I(\beta)$  is decreasing on the interval  $[0, 1]$ . The argument that shows that it is increasing on the interval  $[-1, 0]$  is analogous.

Fix an equilibrium with a given threshold  $\bar{\beta}$ . Recall that the defendant is indifferent between an arbitrator of type  $\beta > 0$  who decides correctly if strategic and an arbitrator of type  $1 - p + p\beta = [(1 + \beta)/2]$  who decides for the plaintiff if strategic and recall that the plaintiff is indifferent between an arbitrator of type  $\beta > 0$  who decides correctly if strategic and an arbitrator of type  $p + \beta(1 - p) = [(1 + \beta)/2]$  who decides for the plaintiff if strategic. First, consider the case in which

$$\frac{1 + \beta}{2} \leq \bar{\beta}$$

or in which<sup>30</sup>

$$0 \leq \beta \leq 2\bar{\beta} - 1.$$

An arbitrator of type  $\beta^* \in [0, 2\bar{\beta} - 1]$  would be selected to decide the dispute from a list that includes two other arbitrators, if the type of one of these other arbitrators (young or old) is lower and thus would be vetoed by the defendant (with probability  $.5F^O[\beta^*] + .5F^Y[\beta^*] \equiv G[\beta^*]$ ), and if the type of the other arbitrator (young or old) is higher and thus would be vetoed by the plaintiff (with probability  $1 - .5F^O[\beta^*] - .5F^Y[\beta^*] = 1 - G[\beta^*]$ ). Therefore, the probability that arbitrator  $\beta^*$  is selected to decide the dispute is

30. If  $2\bar{\beta} - 1 \leq 0$  or  $\bar{\beta} \leq \frac{1}{2}$ , then proceed to the next case.

$$2G(\beta^*)[1 - G(\beta^*)].$$

The derivative of this function with respect to  $\beta^*$  is  $2G(\beta^*)[1 - 2G(\beta^*)] < 0$  because  $G$  is an average of two cumulative distribution functions and hence increasing and because symmetry and the fact that  $F^O$  has a mass point at zero imply that  $G(0) > \frac{1}{2}$ .

Next, consider the case in which  $\beta > 0$  is such that

$$\beta \leq \bar{\beta} < \frac{1 + \beta}{2}$$

or in which

$$2\bar{\beta} - 1 \leq \beta \leq \bar{\beta}.$$

An arbitrator of type  $\beta^* \geq 0$  that belongs to this interval would be selected to decide the dispute from a list that includes two other arbitrators if (1) either one of the other two arbitrator's types is old and belongs to interval  $[-1, \beta^*]$  or is young and belongs to the set  $[-1, \beta^*] \cup [\bar{\beta}, (1 + \beta^*)/2]$  and so is vetoed by the defendant with probability  $.5F^O(\beta^*) + .5F^Y(\beta^*) + .5F^Y[(1 + \beta^*)/2] - .5F^Y(\bar{\beta}) \equiv G(\beta^*)$  and (2) the type of the other arbitrator is either old and belongs to the interval  $[\beta^*, 1]$  or is young and belongs to the set  $[\beta^*, \bar{\beta}] \cup [(1 + \beta^*)/2, 1]$  and so is vetoed by the plaintiff with probability  $.5[1 - F^O(\beta^*)] + .5[F^Y(\bar{\beta}) - F^Y(\beta^*) + 1 - F^Y[(1 + \beta^*)/2]] = 1 - G(\beta^*)$ . Thus, the probability that arbitrator  $\beta^*$  is selected to decide the dispute is  $2G(\beta^*)[1 - G(\beta^*)]$ , which is decreasing as before.

Finally, consider the case in which

$$\bar{\beta} < \beta.$$

This case is again simpler, and the proof is similar to the first case analyzed above.

To conclude the proof of the proposition, we need to show that the probability  $P^l(\beta)$  has a discontinuous jump at  $P^l(0)$ . Let  $H(\beta) \equiv .5F^O(\beta) + .5F^Y(\beta)$ , and denote the mass point of  $H$  at 0 by  $h > 0$ . The probability that an arbitrator of type 0 is selected to decide the dispute out of a list of three arbitrators is

$$\frac{1}{2}(1 - h^2) + \frac{1}{3}h^2.$$

The probability that an arbitrator of type  $\beta \searrow 0$  is selected to decide the dispute is

$$2\left(\frac{1}{2} + \frac{h}{2}\right)\left(\frac{1}{2} - \frac{h}{2}\right) = \frac{1 - h^2}{2}.$$

The former probability is strictly larger than the latter for every  $b > 0$ . Q.E.D.

### Proof of Proposition 3

The probability that an employer of type  $\beta \in [-1, 1]$  is employed under the No Veto regime is independent of  $\beta$ .

We compute the probability that an arbitrator of type  $\beta \in [-1, 1]$  is employed under the Veto + Unobservable Information regime. Given three different arbitrators' types  $\beta_0 < \beta_1 < \beta_2$ , the plaintiff would veto arbitrator  $\beta_2$ , the defendant would veto arbitrator  $\beta_0$ , and therefore arbitrator  $\beta_1$  would be employed. For a given  $\beta$ , the probability that of two other  $\beta$  values there is exactly one  $\beta$  that is smaller and one  $\beta$  that is larger is<sup>31</sup>

$$P^\circ(\beta) = 2\hat{F}(\beta)[1 - \hat{F}(\beta)].$$

For any monotone function  $\hat{F}$ , the probability  $P(\beta)$  is increasing for  $-1 \leq \beta \leq 0$ , decreasing for  $0 \leq \beta \leq 1$ , and maximized at  $\beta = 0$ , where it equals  $\frac{1}{2}$ .

This means that less biased arbitrators with a lower type  $|\beta|$  are more likely to be employed under the Veto + Unobservable Information regime than the No Veto regime and that highly biased arbitrators with a higher type  $|\beta|$  are more likely to be employed under the No Veto regime than the Veto + Unobservable Information regime. Q.E.D.

### Proof of Proposition 4

If  $b$  is small, then arbitrators behave identically under the two regimes. The superior selection that is afforded by the Veto + Observable Information regime implies that it generates a higher probability of a correct decision. Q.E.D.

### Proof of Proposition 5

Strategic arbitrators decide correctly under the Veto + Unobservable Information regime. Since all arbitrators appear as either of type  $\beta_0$  or  $-\beta_0$ , one of these types is always selected to decide the dispute. If the arbitrator is unbiased, then she decides the case correctly. Since biased

31. The fact that  $F$  is continuous implies that the probability of a tie is zero and so can be ignored.

arbitrators also decide correctly half of the time (by the assumption that  $p = .5$ ), the probability of a correct decision under this regime is

$$1 - \beta_0 + \frac{\beta_0}{2} = 1 - \frac{\beta_0}{2}.$$

Under the Veto + Observable Information regime, young arbitrators may have two equally likely types:  $\beta_0$  and  $-\beta_0$ . Since the decision made by young arbitrators reveals their bias, old arbitrators have five possible types: inexperienced and hence of type  $\beta_0$ , type  $-\beta_0$ , pro-plaintiff, pro-defendant, and unbiased. If old arbitrators are inexperienced with probability  $q$ , then the probability that an old arbitrator has type  $\beta_0$  or  $-\beta_0$  is  $\frac{q}{2}$ , the probability that an old arbitrator is pro-plaintiff or pro-defendant is  $[(1 - q)\beta_0]/2$ , and the probability that an old arbitrator is unbiased is  $[(1 - q)(1 - \beta_0)]/2$ . This means that there are  $7^3$  (that is, 343) different three-arbitrator panels. We divide this set of panels into four subsets: panels with three young arbitrators, panels with two young arbitrators and one old arbitrator, panels with one young arbitrator and two old arbitrators, and panels with three old arbitrators. Below we calculate the probability that a given panel belongs to each subset and determine the probability that a correct decision is made in each subset: a young arbitrator is selected to appear in a panel of three arbitrators that consists of three, two, and one young arbitrators with probabilities  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and  $\frac{1}{4}$ , respectively.<sup>32</sup>

In a stationary equilibrium, the probability that an old arbitrator is inexperienced is equal to the probability that a young arbitrator is not selected. We denote this probability by  $q$  and calculate it below. A young arbitrator (with type  $\beta_0$  or  $-\beta_0$ ) is chosen from a panel of three young arbitrators with probability  $\frac{1}{3}$ . A young arbitrator is chosen from a panel that consists of two young arbitrators and one old arbitrator with probability<sup>33</sup>

$$\frac{1}{4} + \frac{q}{12} + \frac{\beta_0(1 - q)}{4}.$$

32. Notice that panels with one or two young arbitrators are three times more likely than a panel with three young arbitrators.

33. Because with probability  $\frac{1}{2}$  the two young arbitrators have identical types and a young arbitrator is then chosen with probability  $(1 - \frac{q}{2})\frac{1}{2} + \frac{q}{2} \times \frac{1}{3}$ , and because with probability  $\frac{1}{2}$  the two young arbitrators have different types and a young arbitrator is then chosen with probability  $(1 - q)(\beta_0/2) + \frac{q}{2} \times \frac{1}{2}$ . The overall probability is

$$\frac{1}{2} \left[ \left(1 - \frac{q}{2}\right) \frac{1}{2} + \frac{q}{2} \times \frac{1}{3} \right] + \frac{1}{2} \left[ (1 - q) \frac{\beta_0}{2} + \frac{q}{2} \times \frac{1}{2} \right] = \frac{1}{4} + \frac{q}{12} + \frac{\beta_0(1 - q)}{4}.$$



A young arbitrator is chosen from a panel that consists of one young and two old arbitrators with probability<sup>34</sup>

$$\frac{q^2}{3} + q\left(1 + \frac{\beta_0^2}{4}\right) - q^2\left(1 + \frac{\beta_0}{2}\right) + \frac{\beta_0}{2}\left(1 - \frac{\beta_0}{2}\right).$$

Therefore, a young arbitrator is chosen with probability

$$\begin{aligned} &\frac{1}{4} \times \frac{1}{3} + \frac{1}{2}\left[\frac{1}{4} + \frac{q}{12} + \frac{\beta_0(1-q)}{4}\right] \\ &+ \frac{1}{4}\left[\frac{q^2}{3} + q\left(1 + \frac{\beta_0^2}{4}\right) - q^2\left(1 + \frac{\beta_0}{2}\right) + \frac{\beta_0}{2}\left(1 - \frac{\beta_0}{2}\right)\right]. \end{aligned}$$

In a stationary equilibrium, this probability is equal to the probability that an old arbitrator is experienced, which is equal to  $1 - q$ . This allows us to solve for the equilibrium value of  $q$ , which is equal to<sup>35</sup>

$$q = \frac{31 - 3\beta_0 + (3/2)\beta_0^2 - (1/2)\sqrt{3}\sqrt{3\beta_0^4 - 36\beta_0^3 + 200\beta_0^2 - 424\beta_0 + 876}}{6\beta_0 + 8}.$$

A panel of three arbitrators consists of three young arbitrators with probability  $\frac{1}{8}$ , and the arbitrator who is selected from such a panel de-

34. (1) With probability  $q^2/4$ , the two old arbitrators are inexperienced and have the same type as the young arbitrator, and in this case the young arbitrator is chosen with probability  $\frac{1}{3}$ . (2) With probability  $q^2/2$ , the two old arbitrators are inexperienced and have two different types, and in this case the young arbitrator is chosen with probability  $\frac{1}{2}$ . When the two old arbitrators are inexperienced and have a different type from the young arbitrator, the young arbitrator is not chosen. (3) With probability  $2q(1 - q)$ , one of the old arbitrators is experienced and the other is not. In this case, the young arbitrator is chosen with probability  $\frac{1}{2} + \frac{1}{2} \times (\beta_0/2)$  because with probability  $\frac{1}{2}$  the old inexperienced arbitrator has the same type as the young arbitrator, and in this case the young arbitrator is chosen with probability  $\frac{1}{2}$  regardless of the type of the experienced old arbitrator. (4) With probability  $\frac{1}{2}$ , the inexperienced old arbitrator has a different type from the young arbitrator, and in this case the young arbitrator is chosen if and only if the experienced old arbitrator is either pro-plaintiff or pro-defendant (depending on the young arbitrator's type). (5) Finally, with probability  $(1 - q)^2$ , both old arbitrators are experienced, and in this case the young arbitrator is chosen if and only if one of the old arbitrators is pro-plaintiff or pro-defendant (depending on the young arbitrator's type) and the other is not, with probability  $(\beta_0/2)(1 - [\beta_0/2])$ . Hence, the probability that the young arbitrator is chosen is

$$\begin{aligned} &\frac{q^2}{4} \times \frac{1}{3} + \frac{q^2}{2} \times \frac{1}{2} + 2q(1 - q)\left(\frac{1}{2} + \frac{1}{2} \times \frac{\beta_0}{2}\right) + (1 - q)\frac{\beta_0}{2}\left(1 - \frac{\beta_0}{2}\right) \\ &= \frac{q^2}{3} + q\left(1 + \frac{\beta_0^2}{4}\right) - q^2\left(1 + \frac{\beta_0}{2}\right) + \frac{\beta_0}{2}\left(1 - \frac{\beta_0}{2}\right). \end{aligned}$$

35. Plotting this as a function of  $\beta_0$  reveals that it is a monotone function that decreases almost linearly from .671 at  $\beta_0 = 0$  to .568 at  $\beta_0 = 1$ .

cides correctly with probability  $\frac{1}{2}$ .<sup>36</sup> A panel of three arbitrators consists of two young and one old arbitrators with probability  $\frac{3}{8}$ , and the arbitrator who is selected from such a panel decides correctly with probability<sup>37</sup>

$$\frac{3}{4} - \frac{q}{8} + \frac{q\beta_0}{8} - \frac{\beta_0}{4}.$$

A panel of three arbitrators consists of two old and one young arbitrators with probability  $\frac{3}{8}$ , and the arbitrator who is selected from such a panel decides correctly with probability<sup>38</sup>

36. Both young strategic arbitrators and young nonstrategic arbitrators always bias their decision in equilibrium. Their decision is correct with probability  $\frac{1}{2}$ .

37. (1) With probability  $\frac{1}{2}$ , the two young arbitrators have the same type, and in this case one of them is chosen to arbitrate the dispute and decides correctly with probability  $\frac{1}{2}$  regardless of the type of the old arbitrator. (2) With probability  $\frac{1}{2}$ , the two young arbitrators have different types. With probability  $q$ , the old arbitrator is inexperienced, and in this case a young arbitrator is chosen to decide the dispute with probability  $\frac{1}{2}$  and decides correctly with probability  $\frac{1}{2}$ . With probability  $\frac{1}{2}$ , the old arbitrator decides correctly with probability  $1 - (\beta_0/2)$ . (3) With probability  $1 - q$ , the old arbitrator is experienced and in this case, with probability  $\beta_0$ , one of the young arbitrators is chosen to arbitrate the dispute and decides correctly with probability  $\frac{1}{2}$ , and with probability  $1 - \beta_0$  an old unbiased arbitrator is selected to arbitrate the dispute and decides correctly with probability 1. This yields the probability

$$\begin{aligned} & \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \left[ q \left[ \frac{1}{2} \times \frac{1}{2} + \frac{1}{2} \left( 1 - \frac{\beta_0}{2} \right) \right] + (1 - q) \left( \frac{\beta_0}{2} + 1 - \beta_0 \right) \right] \\ & = \frac{3}{4} - \frac{q}{8} + \frac{q\beta_0}{8} - \frac{\beta_0}{4}. \end{aligned}$$

38. (1) If the two old arbitrators are both inexperienced (with probability  $q^2$ ), then the correct decision is made with probability  $\frac{1}{4}[1 - (\beta_0/2)] + \frac{1}{2}[\frac{1}{2}[1 - (\beta_0/2)] + \frac{1}{2} \times \frac{1}{2}] + \frac{1}{4}[\frac{2}{3}[1 - (\beta_0/2)] + \frac{1}{3} \times \frac{1}{2}] = \frac{5}{6} - (\beta_0/3)$ . (2) If one old arbitrator is inexperienced and the other is experienced (with probability  $2q[1 - q]$ ), then the correct decision is made with probability  $\frac{1}{2}[\frac{2}{3}[1 - (\beta_0/2)] + \frac{1}{2} \times \frac{1}{2}] + \frac{1}{2}[(\beta_0/2) \times \frac{1}{2} + 1 - \beta_0 + (\beta_0/2)[1 - (\beta_0/2)]] = \frac{7}{8} - (\beta_0/4) - (\beta_0^2/8)$ . (3) Finally, if the two old arbitrators are both experienced (with probability  $[1 - q]^2$ ), then the correct decision is made with probability 1 if and only if both the old arbitrators are unbiased or if one is unbiased and the other is biased in the direction opposite that of the young arbitrator on the panel, with probability  $(1 - \beta_0)^2 + 2\beta_0(1 - \beta_0)$ . (4) In all other cases, the selected arbitrator always biases its decision, and so decides correctly with probability  $\frac{1}{2}$ . The probability of a correct decision is therefore

$$\begin{aligned} & q^2 \left( \frac{5}{6} - \frac{\beta_0}{3} \right) + 2q(1 - q) \left( \frac{7}{8} - \frac{\beta_0}{4} - \frac{\beta_0^2}{8} \right) \\ & + (1 - q)^2 \left\{ (1 - \beta_0)^2 + 2\beta_0(1 - \beta_0) + [1 - (1 - \beta_0)^2 - 2\beta_0(1 - \beta_0)] \frac{1}{2} \right\} \end{aligned}$$

or

$$\frac{q^2}{12} - \frac{q\beta_0}{2} - \frac{\beta_0^2}{2} - \frac{q}{4} + \frac{q^2\beta_0}{6} + \frac{q\beta_0^2}{2} + 1.$$

$$\frac{q^2}{12} - \frac{q\beta_0}{2} - \frac{\beta_0^2}{2} - \frac{q}{4} + \frac{q^2\beta_0}{6} + \frac{q\beta_0^2}{2} + 1.$$

Finally, a panel of three arbitrators consists of three old arbitrators with probability  $\frac{1}{8}$ . The arbitrator who is selected from such a panel decides correctly with probability<sup>39</sup>

$$\begin{aligned} & q^3\left(1 - \frac{\beta_0}{2}\right) + 3q^2(1 - q)\left(1 - \frac{\beta_0}{4} - \frac{\beta_0^2}{4}\right) \\ & + 3q(1 - q)^2\left[\frac{\beta_0^2}{4} + \frac{\beta_0}{2}\left(1 - \frac{\beta_0}{2}\right)^2\right] + (1 - \beta_0)\left(1 - \frac{\beta_0}{2}\right) \\ & + (1 - q)^3\left[1 - \left(\frac{\beta_0}{2}\right)^3 - 3\left(\frac{\beta_0}{2}\right)^2(1 - \beta_0)\right]. \end{aligned}$$

Summing up and plotting the probability of a correct decision under the Veto + Observable Information and Veto + Unobservable Information regimes as a function of  $\beta_0$  reveals that the latter generates a higher probability of a correct decision than the former for any value of  $\beta_0$  that lies strictly between 0 and 1. Q.E.D.

39. (1) If all three arbitrators are inexperienced (with probability  $q^3$ ), then the correct decision is made with probability  $1 - (\beta_0/2)$ . (2) If two of the three old arbitrators are inexperienced (with probability  $3q^2[1 - q]$ ), then the correct decision is made with probability  $\frac{1}{2}[1 - (\beta_0/2)] + \frac{1}{2}[\beta_0[1 - (\beta_0/2)] + 1 - \beta_0] = 1 - (\beta_0/4) - (\beta_0^2/4)$ . (3) If one of the old arbitrators is inexperienced (with probability  $3q[1 - q]^2$ ), then the correct decision is made with probability  $(\beta_0^2/4) + (\beta_0/2)[1 - (\beta_0/2)]^2 + (1 - \beta_0)[1 - (\beta_0/2)]$ . (4) Finally, if all three old arbitrators are experienced (with probability  $[1 - q]^3$ ), then a biased decision is made with probability 1 if and only if at least two of the old arbitrators on the panel are biased in the same direction, with probability  $2[(\beta_0/2)^3 + 3(\beta_0/2)^2(1 - \beta_0)]$ . (5) In all other cases, the correct decision is made with probability 1. Thus, the probability of a correct decision in this case is

$$\begin{aligned} & 2\left[\left(\frac{\beta_0}{2}\right)^3 + 3\left(\frac{\beta_0}{2}\right)^2(1 - \beta_0)\right]\frac{1}{2} + 1 - 2\left[\left(\frac{\beta_0}{2}\right)^3 + 3\left(\frac{\beta_0}{2}\right)^2(1 - \beta_0)\right] \\ & = 1 - \left(\frac{\beta_0}{2}\right)^3 - 3\left(\frac{\beta_0}{2}\right)^2(1 - \beta_0). \end{aligned}$$

The overall probability of a correct decision is

$$\begin{aligned} & q^3\left(1 - \frac{\beta_0}{2}\right) + 3q^2(1 - q)\left(1 - \frac{\beta_0}{4} - \frac{\beta_0^2}{4}\right) \\ & + 3q(1 - q)^2\left[\frac{\beta_0^2}{4} + \frac{\beta_0}{2}\left(1 - \frac{\beta_0}{2}\right)^2\right] + (1 - \beta_0)\left(1 - \frac{\beta_0}{2}\right) \\ & + (1 - q)^3\left[1 - \left(\frac{\beta_0}{2}\right)^3 - 3\left(\frac{\beta_0}{2}\right)^2(1 - \beta_0)\right]. \end{aligned}$$

### Proof of Proposition 6

The proof follows from the fact that the expectation of the intermediate value of  $\beta$  is equal to the median of the distribution  $F$  (David and Nagaraja 2003). Q.E.D.

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