Innocuous Time-Saver or Counter-majoritarian Loophole? The Cert Pool and Policy on the U.S. Supreme Court*

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Version 3.2

Abstract

Since 1972, the certiorari petitions that arrive at the Supreme Court are randomly assigned for review to one of the five to eight justices who are members of the Supreme Court cert pool. Justices who are not members of the pool still review each petition. Thus, some petitions for review are evaluated by as few as two justices (or their clerks), and the rest of the Court relies on the recommendations of these justices. This practice has been criticized for its potentially counter-majoritarian implications. Formalizing the communication between the better-informed justices who review a petition and the rest of the Court as a sender-receiver game, I assess the circumstances under which the Court median's preferred policy outcome is subverted. Then, I analyze the decision to opt out of the cert pool. In some equilibria, the cert pool can move policy away from the median justice; in others—specifically, those in which one justice on each side of the median opts out of the cert pool—it is predicted to have no influence. Empirical patterns of cert pool membership in the last eleven natural courts are consistent with equilibrium predictions.

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Introduction

The Supreme Court cert pool is a relatively little-noted institution that, more than any other Court practice, has the potential to set radically nonmajoritarian legal policy. Instituted in 1972, the cert pool originally consisted of five justices' clerks who were "pooled together" to deal with the rapidly-growing number of petitions for certiorari (Palmer 2001, 107). Previously, the clerks of each justice were responsible for evaluating the petitions for certiorari and authoring a "cert memo" that recommended that the justice either vote to grant or deny the petition. With the cert pool, all justices who were part of the pool received only a single "pool memo" recommending a grant or denial, authored by a single, randomly-assigned pool clerk. This has raised some concern that a single justice, through his law clerk, can have outsize influence on whether individual cases are heard—potentially leaving policy in place that is radically divergent from the preferences of the Court as a whole (see e.g., examples cited in Palmer 2001, 105-6).

Spatial models of policymaking have been fruitfully applied to the Court's decision on the merits (e.g., Segal and Spaeth 2002), Court opinions (e.g., Anderson and Tahk 2007) opinion assignment (e.g., Slotnick 1979), and certiorari voting (e.g., Caldeira, Wright and Zorn 1999). The decision to opt in or out of the cert pool, however, has not been analyzed within a spatial framework. In doing just that, this paper addresses the following questions: Under what conditions does the cert pool have influence–when does the pool lead to policy outcomes that diverge from those that would result in its absence? What is the source of the pool's (potential) influence? Does the relatively high rate of disagreement between the pool recommendation and the Court decision as a whole necessarily indicate a lack of influence? Which justices should opt in to the pool?

Literature Review

There are few works of political science or legal scholarship that address the cert pool, and fewer yet that present any systematic empirical evidence on its influence. Palmer (2001) is an important exception: the paper analyzes the pool memo recommendations and justice cert votes for five terms of the Court, 1972–1974 and 1984–1985. Palmer (2001) argues that journalistic criticisms of cert pool influence are unwarranted, as she finds that—among cases granted by the Court—justices in the pool do not as a rule agree with the pool memo recommendation, and almost never vote as a block against the justices outside of the pool.[1]

[1]Palmer's analysis is restricted to cases granted by the Court as a whole, since pool memos were only available for granted cases; the subsequent release of the Blackmun papers allows for analysis of pool memos in Court denials as well.

Further noting that a granted case had a pool memo recommending a grant only about half of the time, Palmer (2001, 120) argues that the cert pool "does not determine which cases the Court ultimately decides" and "serves primarily as a time-saver and not an initial case-screener."

A law review article by Stras (2007) examines pool memo and justice-Court agreement in both denied and granted cases, for four terms: 1984, 1985, 1991 and 1992. Rather predictably, the overall rate of agreement increases when denied cases are taken into account: petitions for which the Court agrees with a pool-recommended denial form an overwhelming majority of all petitions. However, there is no clear over-time trend for the rates of agreement between the Court's collective decision and the pool recommendation. For granted cases, the rates of pool-Court agreement is roughly consistent with those found by Palmer (2001), though direct comparison is hindered by the two authors' sometimes-conflicting coding decisions.

Ward and Weiden (2006) and Peppers (2006) present some qualitative information about the cert pool, as part of larger projects on Court clerks. Peppers (2006, 192–203) notes some variance among pool justices about how much deference is given to the pool memo. For example, Rehnquist clerks were required to annotate all pool memoranda and vet the recommendation before forwarding it to the justice; on the other hand, Kennedy, O'Connor, and Scalia clerks did (do) not mark-up or evaluate pool memos. Also receiving mention is the trade-off between the reduced workload that comes with pool membership and increased oversight that comes from opting out. Chief Justice Rehnquist, who entered the Court before the formation of the cert pool, is quoted to the effect that participation in the cert pool frees up clerks to spend more time drafting opinions (Peppers 2006, 194). Justice Stevens, though, justifies opting out as an "important check against potential mistakes" made by the pool, and Justice Brennan (another nonparticipant) noted that "he would find three to four cases a year the [pool] clerks had missed (Ward and Weiden 2006, 121, 126)."

Ward and Weiden (2006) also uncover some subtle, but potentially strategic manipulation of pool memos. For example, clerks "forget" to note dissents in the court below, or "editorialize" with the case name—so that *R.A.V.* v. *St. Paul*, the hate crime/free speech case involving a cross-burning ordinance, became *R.A.V.(skinhead)* v. *St. Paul* in a Rehnquist clerk's pool memo (Ward and Weiden 2006, 133, 134). Ultimately, though, Peppers (2006) and Ward and Weiden (2006) come to no firm conclusion about the prevalence of strategic pool memo writing, or of the impact of pool participation on the set of cases that are heard.

The theoretical framework I present broadly draws from the formal literature on signaling and information transmission. Such models of limited information have been applied widely by political scientists studying principal-agent problems (for one review, see Bendor, Glazer and Hammond 2001). Variants of these models applied to the Supreme Court have generally focused on interaction between a better-informed lower court and supervisory High Court. Prominently, Cameron, Segal and Songer (2000) showed that lower courts can, to a limited degree, exploit informational advantages vis-a-vis the Supreme Court to avoid review of decisions that a fully informed High Court would reverse. Cameron, Segal and Songer (2000) also proposed a theoretically sound underpinning for the observation that lower courts are more likely to be reversed when when they are ideologically distant from the Supreme Court, and when they bring decisions that appear to allign with own their policy preferences, as opposed to the High Court's. In related work, Lax (2003) shows that justices can exploit uncertainty that lower courts have about the justices' preferences to induce greater compliance by mitigating the lower courts' informational advantage. Recently, Clark (2009*a*) demonstrates that the principal-agent relationship that Cameron, Segal and Songer (2000) showed between the Supreme Court and lower courts also applies to the relationship between subordinate Circuit Court of Appeals panels and supervisory full circuits.[2] Also relevant is Clark (2009*b*), which models the Supreme Court as an agent of the Congress. This paper suggests that through the threat of Court-curbing legislation, Congress—which is better informed about public perception of judicial legitimacy—is able to influence a Court that cares about legitimacy to submit to its preferences.

In each of these papers, the Court is either modeled as a unitary actor, or all justices are assumed to be equally informed about the state of the world. That is to say, all justices have the same information about the decision being reviewed (or, in Clark (2009*b*), public perception of legitimacy). For many purposes, this simplification is warranted. However, it is precisely because not all justices have the same information about the lower court opinion—some read the briefs and opinions directly, and others rely on the recommendation of another justice—that the cert pool may have influence. Therefore, to properly assess its impact, it is necessary to consider informational asymmetries *within* the Court. In the next section, I informally discuss the way in which I do this, as well as some of my other modeling assumptions.

Modeling the Cert Pool

In my analysis of the cert pool, I model justices who care primarily about legal policy. I assume that justices have ideal points on a single liberal-conservative dimension, and they prefer, for a given case, that the policy enunciated be as close to this ideal point as possible. The Court, as a whole, can set policy in one of two ways: it can deny the petition for certiorari

[2] Appeals from federal trial courts are heard by three-judge panels, which are subject to (discretionary) "en banc" review by the full circuit.

and leave in place the legal "status quo" as set forth in the lower court opinion, or (upon the vote of four of its members) it can grant the petition and put forward its own legal policy. If the Court votes to grant, I assume that the policy will be set at the median's ideal point (e.g., Anderson and Tahk 2007). Absent any further constraints, it is straightforward that the Court should grant *every* petition: for any lower court opinion, at least five justices are no worse off if they hear a case and move the status quo to the median's ideal point. However, two other considerations bar this possibility.

The first is that the Court has finite resources to deal with an ever-expanding caseload: in the 1972 term, fewer than 4,000 new petitions for review were filed; by 2002, the number exceeded 8,000. Prima facie, most of these cases are meritless: in recent terms, the Court has reviewed fewer than one percent of petitions filed (Epstein, Segal, Spaeth and Walker 2007, 72-75). Justice Douglas noted in 1969 that "meritorious cases [...] are few and far between" and lamented the "prodigious effort we are making over such a few meritorious cases (Ward and Weiden 2006, 140-141)." Quantitative evidence backs up this assertion: per Stras (2011), in the 1993 term of the Court (the most recent one analyzed), no justice voted to grant more than 1.5% of cert petitions. I therefore assume that in the set of cases before the Court there is some proportion of petitions that all justices would strictly prefer to deny, and that granting such a petition imposes some cost on the justices, without any possible policy benefit. Within a spatial framework, these petitions can be thought of as asking review of lower court opinions that are already fully compliant (i.e., they set policy at the Court median's ideal point). Alternatively, they can be thought of as petitions where the underlying case has no policy implications at all.[3]

The second consideration is that not all justices are fully informed about the lower court decision. In particular, the single randomly-selected justice in the pool assigned the case, as well as any justice(s) not in the pool will review the petition for certiorari, any briefs in opposition, and potentially, the lower court record as a whole.[4] To the contrary, justices who are in the pool and not assigned the petition must rely on the recommendations of the better-

[3] This is admittedly a simple way of modeling the Court's resource constraints. For a more involved attempt, see Clark and Strauss (2010).

[4] Although much of this work is done by clerks, I make the simplifying assumption that clerks are perfect agents of their justices. First, as Ditslear and Baum (2001) point out, justices are in a good position to closely monitor the work of their clerks. What is more, the monitoring may be superfluous, since justices are empirically likely to select clerks from lower court judges who share their ideological preferences—and in recent decades, this pattern of clerk-justice ideological compatibility has grown increasingly pronounced (Ditslear and Baum 2001; Baum and Ditslear 2010). Finally, since almost all contemporary Supreme Court clerks have prior federal appellate experience, (Baum and Ditslear 2010, 26), there is good reason to believe that they will be able to act competently on behalf of their justices.

informed justices who reviewed the petition.[5] To model this, I assume that—for a given cert petition—one randomly selected member of the pool as well as all justices out of the pool learn the location of the status quo exactly. Upon learning the location of the lower court opinion, these justices can make a recommendation to grant the petition (claiming "this lower court decision is not at the Court median's ideal point") or deny the petition (asserting "this lower court opinion is already at the Court median" or "this petition is entirely meritless"). Other justices know only the distribution from which lower court opinions are drawn, so they must rely on these recommendations to determine whether they prefer to move the status quo below to the Court median's ideal point, or leave it in place. Therefore, in terms of a principal-agent problem, one random member of the pool and all justices out of the pool are the better-informed "agents" of the other justices in the pool, who are the "principals."

Of course, cert pool membership is not exogenous: justices make the decision to join (or opt out) based on the relative weights of the apparent informational advantages that accrue to those who opt out of the pool and the costs inherent in the additional effort that it takes to review every petition.[6] This cost to opting out is analogous to the cost of "auditing" that is a common barrier to perfect oversight of subordinates in many principal-agent models. Often, such models incorporate an explicit "punishment" that is leveled upon subordinates who mislead their superiors about the state of the world. (For example, Cameron, Segal and Songer (2000) assumes that a lower court that misleads the Higher Court and is reversed as a result suffers a policy-independent disutility from the reversal. In another context, Austen-Smith and Wright (1994) assume that a legislator can directly punish a lobbyist who is found to have misled her about the consequences of a law.) I do not make this assumption. The reason is that it is unclear how such a punishment could be implemented. Justices—whether in or out of the pool—cannot punish their colleagues directly, as a superior would a subordinate. And since there is "always room for judgment" about whether a given petition should be granted (Ward and Weiden 2006, 133), there is no intrinsic or reputational harm that results from the fact of having a recommendation disregarded.[7] Of course, a justice who prefers a given status quo to the median's ideal point, and has a "deny" recommendation disregarded by the Court will suffer disutility because a less-preferred policy is adopted. But I do not incor-

[5]See Ward and Weiden (2006, 146), for a claim that this is true in a "vast majority of cases that are petitioned to the Court."

[6]Though clerks are stuck with much of the extra work when a justice opts out of the cert pool, the justice certainly suffers loss too, as clerks occupied with reviewing petitions are less available to assist with other duties (see Peppers 2006, 181, 194).

[7]This applies to petitions that are at least arguably meritorious. For a majority of petitions, there is no plausible argument to be made for a grant. However, the model shows that—even absent punishment—a justice will never attempt to deceive her colleagues about the location of a lower court opinion that decides a meritless case, or sets policy at the median's ideal point.

porate an additional, policy-independent punishment for being caught making a misleading recommendation.

There are two other ways in which the model I present diverges from the typical principal-agent model. Both are motivated substantively. First, I have to account for multiple, ideologically distinct agents who send messages to multiple, ideologically distinct principals or "receivers." Moreover—because a randomly selected member of the cert pool becomes fully informed in a given case—the identity of the "agent" is only known probabilistically ex ante, and is dependent on the choice of the other justices to opt out of the pool. This, unavoidably, complicates analysis of the choice that justices face. Second, I make no strong assumptions about the distribution of status quos facing the Court. Absent an analysis that incorporates the potentially strategic choices of lower courts and litigants, there is little ground on which to base an assumption that status quos follow a specific distribution. Moreover, as the ideological makeup of lower courts changes relative to the Supreme Court, it is likely that the set of lower Court opinion locations for which cert petitions are filed varies over time. Therefore, I choose to assume nothing about the specific form of the distribution of lower court opinions, even at the cost of some analytical complexity.

Utility Functions and Game Structure

In this section, I formalize the assumptions I discuss immediately above, and specify the structure of the game. There are nine players (justices), with ideal points ξ_i on a subset of the real line, with median's ideal point, $\xi_5 = 0$. Justices derive utility from policy outcomes represented by real number x, with utility function $u_i(x) = -(\xi_i - x)^2$. (Though I will use a policy space approach, it is straightforward to re-interpret what follows as a case space model.[8]) Set forth in a petition for certiorari is a lower court (status quo) policy x^o, drawn from a known distribution that is continuous on $(-\infty, \infty)$ except for a discontinuity at $x = 0$. The status quo x^o takes on the value 0 with (known) probability p. Assume that, away from 0, the distribution takes on the density $f(x)$. (The appendix shows that very similar results obtain under an alternative assumption about the distribution of status quos). Before x^o is drawn, justices simultaneously decide whether to pay cost $\kappa > 0$ to opt out of the cert pool and observe x^o. After the draw, all justices who paid κ observe x^o, as does one randomly selected justice who did not pay κ and stayed in the pool. All who observed x^o send one of

[8]Specifically, one can think of ξ_i as the most preferred rule of justice i and x^o as the rule, setting local precedent, announced by a given lower court opinion. Then, if a justice i prefers that cases in courts below be disposed of correctly (i.e., according to her preferred rule ξ_i), her utility from a rule x can reasonably be approximated by a quadratic loss utility function, $-(\xi_i - x)^2$. (For a comprehensive discussion of the advantages of the case space approach to modeling courts, see Lax (2011).)

two possible messages: d, recommending that the petition be denied and the policy be left in place, or g, recommending that the petition be granted and the policy be changed to the Court median's ideal point $\xi_5 = 0$.

After the messages are observed, all justices update their beliefs about p and $f(x)$ via Bayes' Rule, and vote either G, to grant the petition or D, to deny the petition. By the "Rule of Four," only four votes to grant are required for the Court to collectively hear the case. Therefore, if at least four justices vote G, the petition is granted, policy is changed to $x = 0$, and justices thus receive payoff $-\xi_i^2$. In addition, if $x^o = 0$, (i.e., the status quo is already at the Court median's ideal point) and the Court collectively grants, all justices pay a penalty $\gamma > 0$.[9] (The appendix shows that a model where *all* reviewed cases incur costs yields essentially identical results). If fewer than four justices vote G, x^o is left in place, and justices receive payoff $-(\xi_i - x^o)^2$.

Perfect Bayesian Equilibria of the Sender-Receiver Game

Before analyzing the decision to opt out of the cert pool, I derive Perfect Bayesian Equilibria for the signaling game with an exogenously given number of senders. Define a justice's **win set** $W(\xi_i)$, as $[0, 2\xi_i]$ if $\xi_i > 0$ and $[2\xi_i, 0]$ if $\xi_i < 0$. This is the set of policies that a justice (weakly) prefers to the median's ideal point—in other words, the set of all status quos that a justice would like to leave in place. Let $\complement W(\xi_i)$ stand for the complement of this set. For a game with one sender, ξ_s, I propose that a Perfect Bayesian Equilibrium (PBE) is as follows.

ξ_s sends g iff $x^o \in \complement W(\xi_s)$, and d iff $x^o \in W(\xi_s)$. Upon receipt of message g, consistency of beliefs requires justices to surmise that x^o is distributed $\propto f(x)$ on $\complement W(\xi_s)$ and takes on value $x^o = 0$ with probability 0. Upon receipt of message d, other justices believe x^o is distributed $\propto f(x)$ on $W(\xi_s)$ and takes on value $x^o = 0$ with probability $p/(p + \int_{W(\xi_s)} f(x)\mathrm{d}x)$. Therefore, given message g, justice ξ_i votes G iff the expected loss from $D|g$ exceeds the expected loss from $G|g$. This is true iff:

$$\int_{\complement W(\xi_s)} (\xi_i - x)^2 f(x)\mathrm{d}x > \int_{\complement W(\xi_s)} \xi_i^2 f(x)\mathrm{d}x + 0\gamma,$$

which always holds for at least five justices. Given message d, justice ξ_i votes G iff the expected loss from $D|d$ exceeds the expected loss from $G|d$:

$$\int_{W(\xi_s)} (\xi_i - x)^2 f(x)\mathrm{d}x > \int_{W(\xi_s)} \xi_i^2 f(x)\mathrm{d}x + p\gamma.$$

[9] As explained in the previous section, this penalty stands in for the time and resource constraints facing the Court: all are worse off if the Court reviews, hears arguments on, and decides a petition challenging a lower court decision that is already fully compliant. Alternatively, the cost could be interpreted as attendant to a case that all agree has no policy implications and is thus unworthy of a grant.

Thus, a sender can guarantee that the Court grant by sending g. On the other hand the Court *may* deny upon receipt of message d—whether it does so depends on the exogenous ξ_s, $f(x)$, p, and γ, in the following way. It is helpful here to define two critical points, $c^+ > 0$, and $c^- < 0$. The points are those that, for a given $f(x)$, p, and γ,

$$\int_0^{2c^+} (\xi_4 - x)^2 f(x) \mathrm{d}x = \int_0^{2c^+} \xi_4^2 f(x) \mathrm{d}x + p\gamma,$$

$$\int_{2c^-}^{0} (\xi_6 - x)^2 f(x) \mathrm{d}x = \int_{2c^-}^{0} \xi_6^2 f(x) \mathrm{d}x + p\gamma.$$

Or, simplifying,

$$p\gamma = \int_0^{2c^+} (x^2 - 2x\xi_4) f(x) \mathrm{d}x,$$

$$p\gamma = \int_{2c^-}^{0} (x^2 - 2x\xi_6) f(x) \mathrm{d}x.$$

I call a justice **credible** iff $\xi_i \in (c^-, c^+)$.[10] Such a justice is credible because, if he is the only sender, and sends d iff $x^o \in W(\xi_i)$, the Court collectively denies the case, since at least six justices "believe" his message and vote D. Specifically, for at least six justices, $p\gamma$, the probability that the status quo is already at $\xi_5 = 0$ times the cost of hearing such a case, outweighs the expected policy benefit from changing the status quo, distributed $\propto f(x)$ over $W(\xi_i)$ to ξ_5. Note that, holding all else constant, a justice who is more ideologically moderate is more likely to be credible.

To summarize, under the proposed PBE, message g results in the Court collectively granting; message d results in the Court collectively denying iff the sender is credible. Consequently, a sender for whom $x^o \notin W(\xi_s)$ has no incentive to defect and send d. Likewise, a sender for whom $x^o \in W(\xi_s)$ can be made no better off by sending g instead of d.

For two senders, ξ_{si} $(i = 1, 2)$ the following is an equilibrium. ξ_{si} sends d iff $x^o \in W(\xi_{si})$, and g iff $x^o \in \complement W(\xi_{si})$. I list the message of ξ_{s1} first, followed by the message from ξ_{s2}: upon receipt of messages d, d, other justices believe x^o is distributed $\propto f(x)$ on $W(\xi_{s1}) \cap W(\xi_{s2})$ and takes on value $x^o = 0$ with probability $p/(p + \int_{W(\xi_{s1}) \cap W(\xi_{s2})} f(x)\mathrm{d}x)$. Therefore, given messages d, d, ξ_i votes G iff:

$$\int_{W(\xi_{s1}) \cap W(\xi_{s2})} (\xi_i - x)^2 f(x) \mathrm{d}x > \int_{W(\xi_{s1}) \cap W(\xi_{s2})} \xi_i^2 f(x) \mathrm{d}x + p\gamma.$$

[10] If c^+ does not exist, all justices such that $\xi_i > c^-$ are credible; if c^- does not exist, all $\xi_i < c^+$ are credible; if neither c^- or c^+ exist, all ξ_i are credible. If there are multiple values of c^+ (c^-), the greatest (least) such c^+ (c^-) is the threshold for credibility.

This holds for at least four justices iff $W(\xi_{s1}) \cap W(\xi_{s2}) \neq \emptyset$—i.e., both signalers are on the same side of the median—*and* $\xi_{s1}, \xi_{s2} \notin (c^-, c^+)$—i.e., neither sender is credible.

Given messages g, d, other justices believe x^o is distributed with density $\propto f(x)$ on $\complement W(\xi_{s1}) \cap W(\xi_{s2})$ and takes on value $x^o = 0$ with probability 0, and therefore vote G iff

$$\int_{\complement W(\xi_{s1}) \cap W(\xi_{s2})} (\xi_i - x)^2 f(x) \mathrm{d}x > \int_{\complement W(\xi_{s1}) \cap W(\xi_{s2})} \xi_i^2 f(x) \mathrm{d}x + 0\gamma,$$

which holds for at least five justices. The case of messages d, g is symmetrical. Finally, when messages g, g are sent, justices believe that x^o is distributed $\propto f(x)$ on $\complement W(\xi_{s1}) \cap \complement W(\xi_{s2})$, and takes on value $x^o = 0$ with probability 0, and vote G iff:

$$\int_{\complement W(\xi_{s1}) \cap \complement W(\xi_{s2})} (\xi_i - x)^2 f(x) \mathrm{d}x > \int_{\complement W(\xi_{s1}) \cap \complement W(\xi_{s2})} \xi_i^2 f(x) \mathrm{d}x + 0\gamma.$$

Again, this holds for at least five justices. To summarize, in equilibrium, at least five justices vote G, and thus the Court collectively grants whenever at least one sender sends g. Thus no sender ξ_{si} for whom $x^o \notin W(\xi_{si})$ can benefit by defecting to d. If both senders send d, the Court denies whenever the senders are not on the same side of the median justice, or, where they are on the same side, if at least one of the signalers is credible. Thus, no sender ξ_{si} for whom $x^o \in W(\xi_{si})$ can benefit by defecting to g.

There are analogous PBE for the case of any number of senders: sender ξ_{si} sends d if $x^o \in W(\xi_{si})$ and g otherwise, and the Court grants if at least one ξ_{si} recommends g, and, if all recommend d, grants iff, for at least four justices ξ_i:

$$\int_{W(\xi_{s1}) \cap \ldots \cap W(\xi_{si})} (\xi_i - x)^2 f(x) \mathrm{d}x > \int_{W(\xi_{s1}) \cap \ldots \cap W(\xi_{si})} \xi_i^2 f(x) \mathrm{d}x + p\gamma.$$

To be sure, these are not the only PBE that exist. Notably, there are less informative equilibria that nonetheless result in the same collective decision by the Court as the PBE just described, given $f(x)$, p, γ, and the number of senders. First, for the case where there is a single non-credible sender, the message in the PBE described above has no impact on the Court's collective decision—the Court grants anyway. So the recommendation $g | x^o \in W(\xi_s)$ or any mix of g and d, given $x^o \in W(\xi_s)$ is PBE for the non-credible sender. The same is true for any number of non-credible senders: for status quos in their respective win sets, any message is in equilibrium, given that the strategies of any other senders remain as described above. Second, in the PBE described above, as long as one sender, ξ_{si}, recommends g (only) upon observing $x^o \notin W(\xi_{si})$, the Court collectively grants. Therefore, no message of any other sender can change the outcome, and thus, all messages are in equilibrium (given that at least one sender sends g iff the status quo is outside his win set). The analysis of the decision to opt out of the cert pool applies exactly as given to these less informative equilibria as well.[11]

It is worth emphasizing that a strategy profile in which a sole, non-credible sender "imitates" a credible justice cannot be in equilibrium. Concretely, consider the strategy for non-credible sender $\xi_s > c^+$ whereby ξ_s sends g iff $x^o \notin (0, 2c^+)$, and d iff $x^o \in [0, 2c^+]$. Upon receipt of message g, justices must believe that x^o is distributed $\propto f(x)$ on $(-\infty, 0) \cup (2c^+, \infty]$ and takes on value $x^o = 0$ with probability 0. Upon receipt of message d, other justices believe x^o is distributed $\propto f(x)$ on $[0, 2c^+]$ and takes on value $x^o = 0$ with probability $p/(p + \int_0^{2c^+} f(x)\mathrm{d}x)$. Therefore—by the definition of c^+—at least six vote to deny the petition upon the receipt of message d. But then ξ_s will exploit this, and defect from the proposed equilibrium strategy by also sending d if $x^o \in (2c^+, 2\xi_s]$. Thus, even though a non-credible $\xi_s > c^+$ would be better off if she could commit to sending d iff $x^o \in [0, 2c^+]$—her recommendation to deny would be followed for a subset of the status quos she prefers to the Court median's ideal point—the inability to credibly commit to this strategy ensures that it cannot be in equilibrium. For the same reason, no strategy in which multiple non-credible senders on the same side of the median "imitate" credible senders can be a PBE.

A straightforward implication of the sender-receiver game above is that the cert pool has potential influence insofar as it leaves in place status quos that a fully-informed Court would move to its median members' ideal point. The converse is does not hold: the cert pool cannot lead to grants of petitions that a fully-informed Court would deny. Also, because a grant recommendation is sufficiently informative about the location of the status quo to cause at least five justices to grant, the other four justices—whether in the pool or out—cannot influence the collective outcome. Therefore, they may vote sincerely (or in any other manner) in equilibrium. This means that among granted cases, a high rate of agreement among pool justices should not necessarily be expected. Rather, voting agreement in granted cases should be a function of the ideological coherence of the pool. Indeed, Palmer (2001, 115) finds that—for cert votes in cases ultimately granted—justices who were members of the initial cert pool voted with each other at comparable rates in the terms immediately before the institution of the cert pool and in the terms immediately following. Notably, this does not necessarily mean that the pool lacks influence; rather, its influence is not over cases that the Court hears, but the cases that it does not. Below, I consider the circumstances in which justices will opt out

[11] However, it does not apply to any babbling equilibria, where no information is transmitted via the signals. In such equilibria, which exist in all cheap-talk games, senders do not condition their message on x^o, and justices vote only based on their prior beliefs about $f(x)$ and p (and given this, senders have no incentive to defect from their "babbling"). These equilibria, in which recommendations are completely meaningless, are not discussed further.

and "audit" the cert pool to mitigate this influence.

Stage Game of Decision to Opt Out of Cert Pool

Having analyzed the sender-receiver game for an exogenous number of senders, I now consider the conditions under which a justice will pay the cost of opting out of the cert pool in order to always send a signal. When making the decision to opt out of the pool, there are two costs and two benefits for a justice to consider. Most clearly, there is the cost κ, which corresponds to the effort that is required to ascertain the status quo for a given case. Less obvious is the loss of the chance to send an uncontroverted message: if one is a member of a nine-member cert pool, every ninth case (on average) will be decided based on no recommendation other than one's own. A justice who is out of the pool makes a recommendation for every case, but that recommendation is never the sole message—a member of the pool always makes a recommendation, which might serve to the former's disadvantage. For example, consider the case where all justices are credible: if all are in the pool, the most extreme justice on either side will be able to leave in place status quos that only he prefers to the median's ideal point, when he writes the pool memo; if the extremist opts out, though, such status quos will be met with a grant recommendation by every pool justice (in turn), and so the Court will move those status quos to the median.

On the other hand, there are two distinct advantages to opting out of the pool. First, a justice who is out of the pool can ensure that all status quos that are out of his win set are reviewed by the Court and moved to the median. As noted above, by recommending a grant whenever he prefers the median's ideal point to the status quo, his message convinces at least four others to join him and grant the case—irrespective of the messages sent by any other justices. Second, a justice who opts out of the pool can make the the denial recommendation of pool justices credible, by sending the same message. Specifically, when a credible justice who has opted out of the pool and a non-credible justice in the pool both favor keeping in place a status quo, the second message, sent by the credible justice, makes the denial recommendation credible, while a denial recommendation for the same status quo made solely by the non-credible pool justice would be disregarded in equilibrium. This particular advantage only accrues though, if the justice opting out is credible, and there is at least one justice on his side of the median who is in the pool and not credible.

Formally, the expected loss for ξ_i from staying in the pool, when all others are in the pool, $\text{EL}_i(\text{In} \mid \text{All In})$, is:

$$\frac{1}{9}\left[\sum_{\xi_s\in(c^-,c^+)}\int_{W(\xi_s)}(\xi_i-x)^2 f(x)\mathrm{d}x+\sum_{\xi_s}\int_{\complement W(\xi_s)}\xi_i^2 f(x)\mathrm{d}x+\sum_{\xi_s\notin(c^-,c^+)}\left(\int_{W(\xi_s)}\xi_i^2 f(x)\mathrm{d}x+p\gamma\right)\right].$$

The first sum, which is taken over all credible pool senders, is the utility loss when a credible cert pool member observes a status quo in his win set. Because the recommendation of a sole credible sender is always followed, all status quos in credible recommenders' win sets are left in place, and justice ξ_i suffers the attendant utility loss. The second sum, taken over all pool senders, is the expected utility loss for all status quos that are outside the senders' respective win sets. Because in equilibrium, all such status quos are moved to the median, justice ξ_i loses ξ_i^2 over these status quos. The third sum, taken over all non-credible senders, is the expected loss over status quos that are in the win sets of non-credible senders. Since non-credible signalers never persuade the Court to deny a petition, all such status quos within their win sets are moved to the median, and ξ_i suffers loss ξ_i^2; in addition, whenever the the status quo is already at ξ_5, which occurs with probability p, a loss of γ is incurred.

On the other hand, the expected loss for ξ_i if he opts out of the pool, given that all others opt in, $\mathrm{EL}_i(\mathrm{Out} \mid \mathrm{All\ In})$, is:

$$\frac{1}{8}\Bigg[\sum_{\substack{\xi_s\neq\xi_i,\\ \xi_s \text{ or } \xi_i\\ \in(c^-,c^+)}}\int_{W(\xi_s)\cap W(\xi_i)}(\xi_i-x)^2 f(x)\mathrm{d}x+\sum_{\xi_s\neq\xi_i}\int_{\complement[W(\xi_s)\cap W(\xi_i)]}\xi_i^2 f(x)\mathrm{d}x+$$
$$\sum_{\substack{\xi_s\neq\xi_i,\\ \xi_i,\xi_s\\ \notin(c^-,c^+)}}\left(\int_{W(\xi_s)\cap W(\xi_i)}\xi_i^2 f(x)\mathrm{d}x+p\gamma\right)\Bigg].$$

The first sum refers to the expected loss incurred when the status quo is in the intersection of ξ_i and the signaler's win set, and at least one of these justices is credible. The second sum refers to the expected loss for status quos that fall outside the intersection of the sender and ξ_i's win set—that is, the status quos that at least one of the pool sender and the justice out of the pool prefer to grant and move to the median's ideal point. The third sum is the expected loss that accrues over status quos in the intersection of ξ_i and xi_s's win sets, when neither justice is credible.

Consider next the decision by a justice ξ_i to opt out of the pool given that one other justice ξ_j opts out. Notably, if the win sets of these two justices do not intersect, then it is guaranteed that any status quos ξ_i prefers to the Court median will not remain in place. Therefore the only incentive ξ_i has to opt out is to ensure that any status quos in the intersection of the pool signaler and ξ_j's win sets are always moved to the median.[12] Formally, the expected loss for ξ_i for staying in the pool, given that ξ_j has opted out, $\text{EL}_i(\text{In}|\xi_j \text{ Out})$, is:

$$\frac{1}{8}\Bigg[\sum_{\substack{\xi_s \neq \xi_j \\ \xi_s \text{ or } \xi_j \\ \in (c^-, c^+)}} \int_{W(\xi_s)\cap W(\xi_j)} (\xi_i - x)^2 f(x)\mathrm{d}x + \sum_{\xi_s \neq \xi_j} \int_{\complement[W(\xi_s)\cap W(\xi_j)]} \xi_i^2 f(x)\mathrm{d}x + \sum_{\substack{\xi_s \neq \xi_j, \\ \xi_s, \xi_j \\ \notin (c^-, c^+)}} \left(\int_{W(\xi_s)\cap W(\xi_j)} \xi_i^2 f(x)\mathrm{d}x + p\gamma\right)\Bigg].$$

The first sum, taken over every pool sender ξ_s—including ξ_i—refers to the loss incurred by ξ_i over status quos that are in the intersection of ξ_s and ξ_j's win sets, when either ξ_j or ξ_s is credible. The second sum, taken over every pool sender ξ_s, indicates the loss sustained when the status quo falls outside of the intersection of ξ_s and ξ_j's win set. The third sum gives the loss sustained over status quos in the intersection of ξ_s and ξ_j's win sets, in the case that neither the pool signaler nor ξ_j is credible. A justice ξ_i considering the decision to opt out of the pool, given that another justice has opted out, compares the loss above to the loss incurred if he also opts out.

Formally, the expected loss for ξ_i from opting out of the cert pool, given that ξ_j has opted out, $\text{EL}_i(\text{Out}|\xi_j \text{ Out})$, is:

$$\frac{1}{7}\Bigg[\sum_{\substack{\xi_s \neq \xi_i, \xi_j \\ \xi_s \text{ or } \xi_i \text{ or } \xi_j \\ \in (c^-, c^+)}} \int_{W(\xi_s)\cap W(\xi_i)\cap W(\xi_j)} (\xi_i - x)^2 f(x)\mathrm{d}x + \sum_{\xi_s \neq \xi_i, \xi_j} \int_{\complement[W(\xi_s)\cap W(\xi_i)\cap W(\xi_j)]} \xi_i^2 f(x)\mathrm{d}x + \sum_{\substack{\xi_s \neq \xi_i, \xi_j \\ \xi_s, \xi_i, \xi_j \\ \notin (c^-, c^+)}} \left(\int_{W(\xi_s)\cap W(\xi_i)\cap W(\xi_j)} \xi_i^2 f(x)\mathrm{d}x + p\gamma\right)\Bigg].$$

The first sum quantifies the expected loss associated with status quos in the intersection of the ξ_j, ξ_i, and the pool sender's win sets, when at least one is credible. Where ξ_j and ξ_i are on the opposite sides of the median, this intersection is the empty set, for all pool senders. The second sum is the expected loss associated with status quos over complement of the intersection of ξ_j, ξ_i, and ξ_s's win sets. Finally, the third sum gives the loss over status quos that are in the intersection of ξ_j, ξ_i, and ξ_s's win sets, when all three are non-credible.

[12]In the extreme case where neither ξ_j nor any pool signaler on the same side of the median as ξ_j is credible, no ξ_i has any incentive to opt out: all non-median status quos ξ_i disfavors necessarily revert to the median in equilibrium.

For the sake of completeness, I give the expected loss for ξ_i for staying in, given that N justices $\xi_j \ldots \xi_n$ opt out, $\text{EL}_i(\text{In}|\xi_j, \ldots, \xi_n \text{ Out})$:

$$\frac{1}{9-N}\Bigg[\sum_{\substack{\xi_s \neq \xi_j, \ldots, \xi_n, \\ \xi_s \text{ or } \xi_j \text{ or } \ldots \\ \xi_n \in (c^-, c^+)}} \int_{W(\xi_s)\cap W(\xi_j)\ldots\cap W(\xi_n)} (\xi_i - x)^2 f(x)\mathrm{d}x$$

$$+\sum_{\substack{\xi_s \neq \xi_j \\ \ldots \xi_n}} \int_{\complement[W(\xi_s)\cap W(\xi_j)\ldots\cap W(\xi_n)]} \xi_i^2 f(x)\mathrm{d}x + \sum_{\substack{\xi_s \neq \xi_j, \ldots, \xi_n, \\ \xi_s, \xi_j, \ldots \xi_n \\ \notin (c^-, c^+)}} \left(\int_{W(\xi_s)\cap W(\xi_j)\ldots\cap W(\xi_n)} \xi_i^2 f(x)\mathrm{d}x + p\gamma\right)\Bigg],$$

and the the expected loss for ξ_i for opting out, given that N other justices $\xi_j \ldots \xi_n$ opt out, $\text{EL}_i(\text{Out}|\xi_j, \ldots, \xi_n \text{ Out})$:

$$\frac{1}{8-N}\Bigg[\sum_{\substack{\xi_s \neq \xi_i, \ldots, \xi_n, \\ \xi_s \text{ or } \xi_i \text{ or } \ldots \\ \xi_n \in (c^-, c^+))}} \int_{W(\xi_s)\cap W(\xi_i)\ldots\cap W(\xi_n)} (\xi_i - x)^2 f(x)\mathrm{d}x+$$

$$\sum_{\substack{\xi_s \neq \xi_i \\ \ldots \xi_n}} \int_{\complement[W(\xi_s)\cap W(\xi_i)\ldots\cap W(\xi_n)]} \xi_i^2 f(x)\mathrm{d}x + \sum_{\substack{\xi_s \neq \xi_i, \ldots, \xi_n, \\ \xi_s, \xi_i, \ldots \xi_n \\ \notin (c^-, c^+)}} \left(\int_{W(\xi_s)\cap W(\xi_i)\ldots\cap W(\xi_n)} \xi_i^2 f(x)\mathrm{d}x + p\gamma\right)\Bigg].$$

With the expected losses in hand, the stage game equilibria can be characterized. In pure strategies, there are the following equilibria.

- No justice opts out, where there exists no ξ_i such that $\text{EL}_i(\text{In}|\text{All In}) - \text{EL}_i(\text{Out}|\text{All In}) > \kappa$
- One ξ_i, such that (1) there exists no ξ_j for whom $\text{EL}_j(\text{In}|\xi_i \text{ Out}) - \text{EL}_j(\text{Out}|\xi_i \text{ Out}) > \kappa$ and (2) $\text{EL}_i(\text{In}|\text{All Out}) - \text{EL}_i(\text{Out}|\text{All Out}) > \kappa$, opts out and all others opt in.
- Any one pair of justices, ξ_i and ξ_j, such that $\text{EL}_j(\text{In}|\xi_i \text{ Out}) - \text{EL}_j(\text{Out}|\xi_i \text{ Out}) > \kappa$ and $\text{EL}_i(\text{In}|\xi_j \text{ Out}) - \text{EL}_i(\text{Out}|\xi_j \text{ Out}) > \kappa$, opts out and all others opt in.
- Any three justices, ξ_i, ξ_j, and ξ_k, such that $\text{EL}_{i(j)(k)}(\text{In}|\xi_{j(k)(i)}, \xi_{k(i)(j)} \text{ Out})$ $-\text{EL}_j(\text{Out}|\xi_{k(i)(j)}, \xi_{j(k)(i)} \text{ Out}) > \kappa$ opt out, and all others opt in.
- Any four justices, ξ_i, ξ_j, ξ_k and ξ_l, such that $\text{EL}_{i(j)(k)(l)}(\text{In}|\xi_{j(k)(l)(i)}, \xi_{k(l)(i)(j)}, \xi_{l(i)(j)(k)} \text{ Out})$ $-\text{EL}_j(\text{Out}|\xi_{j(k)(l)(i)}, \xi_{k(l)(i)(j)}, \xi_{l(i)(j)(k)} \text{ Out}) > \kappa$ opt out, and all others opt in.

This set of pure strategy equilibria is smaller than it may appear at first glance. First, note that for any two justices ξ_j, ξ_k on opposite sides of the median, $[W(\xi_j) \cap W(\xi_k)]$—the status quos both (weakly) prefer to the median—is just $x = 0$. Therefore, for any other ξ_i,

$$\mathrm{EL}_i(\mathrm{In}|\xi_j, \xi_k \text{ Out}) = \int_{-\infty}^{\infty} \xi_i^2 f(x)\mathrm{d}x = \mathrm{EL}_i(\mathrm{Out}|\xi_j, \xi_k \text{ Out}).$$

So, given that given that a justice on one side of the median is out, no more than one justice on the other side will pay the cost to opt out: once a justice on each side of the median is out of the pool, all status quos revert to the median, and there is no benefit to opting out. Second, observe that for any pair of justices ξ_i and ξ_j, where ξ_j is more moderate (i.e., has ideal point closer to 0) and ξ_i and ξ_j are not on opposite sides of the median, $W(\xi_j)$ is a subset of $W(\xi_i)$. Suppose, with trivial loss of generality, that $\xi_j \geq 0$. (The case where $\xi_j \leq 0$ is entirely parallel.) Then, if ξ_j is credible, $\mathrm{EL}_i(\mathrm{In}|\xi_j \text{ Out}) - \mathrm{EL}_i(\mathrm{Out}|\xi_j \text{ Out})$ can be written as:

$$\frac{1}{8}\left[\sum_{\xi_s \geq 0} \int_0^{\min(2\xi_s, 2\xi_j)} x(x - 2\xi_i) f(x)\mathrm{d}x\right] - \frac{1}{7}\left[\sum_{\substack{\xi_s \neq \xi_i, \\ \xi_s \geq 0}} \int_0^{\min(2\xi_s, 2\xi_j)} x(x - 2\xi_i) f(x)\mathrm{d}x\right],$$

which is less than zero. Therefore, certainly ξ_i will not pay κ to opt out. On the other hand, suppose ξ_j (and therefore the more extreme ξ_i) is not credible, and let $\mathbb{C}$ denote the number of non-credible justices with ideal points greater than zero. Then, the incentive for ξ_i to opt out, given that ξ_j is out, is exactly $(\frac{\mathbb{C}-1}{8} - \frac{\mathbb{C}-2}{7})p\gamma$, which is greater than zero. This has two implications. First, even given that no justice on the opposite side of the median is out of the pool, more than one justice will only be out on a given side of the median if *none* of the justices who are out are credible. Second, no other justice has incentive to opt out if the median opts out.

To summarize the pure strategy equilibria: any number of justices, from zero to four, may opt out of the pool in equilibrium. However, on a given side of the median, there can be more than one justice out of the pool only if none of the justices who is out is credible, and there is no justice out of the pool on the opposite side of the median. Finally, if the median is out of the pool, no other justice will opt out.

The cert pool only influences legal policy outcomes in the equilibrium in which no justice opts out of the pool and the equilibria wherein one or more justices, all on the same side of the median, opt out of the pool. When all justices are in the pool, a credible member is able to leave in place status quos that she prefers to the Court median's ideal point. When one or more justices on the same side of the median opt out, they can leave in place non-median policies that the justice(s) who are out of the pool, and the pool recommender in given case all prefer to the Court median, as long as one of the senders is credible. However, in the equilibrium where a justice on each side of the median opts out, the pool has no influence on policy: all status quos that a fully-informed Court would collectively choose to overturn are moved to the Court median's ideal point.

Empirical Assessment

The most easily observable implications of the model have to do with cert pool membership as a function of ideology. Figure 1 shows that the pattern of cert pool membership is remarkably concordant with the theoretical predictions. Specifically, justices have opted in and out of the cert pool in a pattern that is consistent with equilibrium predictions, for the eleven most recent natural courts—that is, all except the first two natural courts since the adoption of the cert pool.[13] In the third through the fifth natural courts after the institution of the cert pool, the three most liberal justices (William Brennan, Thurgood Marshall, and John Paul Stevens) were the only ones to opt out. This is consistent with the prediction that multiple justices on one side will opt out only if they are each not credible, and if no justice on the opposite side of the median opts out. Granted, there can be no conclusive evidence that Brennan, Marshall and Stevens were not viewed as credible. However, if any justices were not credible Stevens, Marshall, and Brennan are likely candidates. They had, respectively, three of the four most liberal career Martin-Quinn scores among all justices who have served since the pool was established (Martin and Quinn 2002). (The most liberal justice was William O. Douglas, who opted out of the pool in the first natural court after its institution, and was replaced by Stevens.) Moreover, note that the likelihood that a justice is viewed as not credible is decreasing in p, the probability that a given lower court decision is fully compliant, or that a petition seeking review wholly lacks merit. While I lack a direct measure of p, it is prima facie plausible—taking the temporally decreasing grant rate as a rough proxy—that the proportion of lower court decisions that deviate from the Supreme Court's collective preference is decreasing over time (i.e., p is increasing). All else equal, this suggests that the equilibria wherein multiple non-credible justices opt out is more likely to occur in the earlier natural courts (since there are more likely to be non-credible justices on the court). This is also consistent with the hypothesis that Brennan, Marshall, and Stevens were viewed as not credible.

In all natural courts subsequent to the retirements of Brennan and Marshall, no more than

[13]A natural court is defined as a Supreme Court in which membership is static. So, for example, the retirement of John Paul Stevens ended the "Roberts 3" natural court, and the "Roberts 4" natural court began with the confirmation of Elena Kagan.

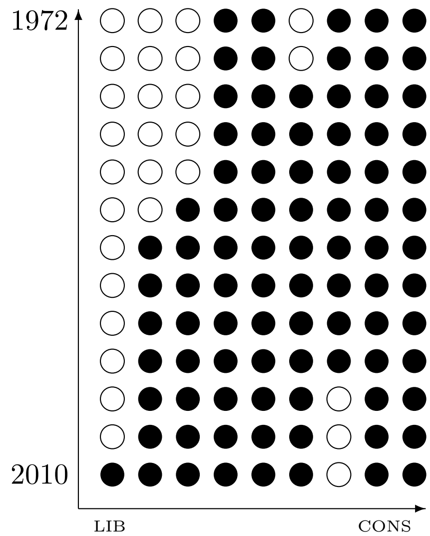

Figure 1: Cert pool membership for the thirteen natural courts since its institution. Filled circles indicate members; empty circles indicate non-members. Each row is a natural court of nine justices, arranged from most liberal to most conservative (average Martin-Quinn score).

one justice on each side of the median opted out, which is fully consistent with the theoretical prediction. Stevens remained the sole justice out of the pool, until Samuel Alito opted out shortly after joining the Court. For the remainder of Stevens' tenure, the two justices remained out of the pool. Following Stevens' retirement, neither his replacement, Kagan, nor any of the others on the liberal wing opted out, leaving Alito as the sole auditor of the pool.

While the patterns of cert pool membership appear consistent with the theoretical predictions, evidence on the actual influence of the cert pool is more elusive. As argued above, voting coherence on cert within the pool is neither necessary nor sufficient to show that the cert pool is influential. Given the high base rate of denials—the thousands of petitions per term that the Court unanimously rejects as meritless—finding systematic evidence that cases that would be otherwise granted were rejected because of an "unchecked" cert pool is difficult.

However, data presented by Epstein, Landes and Posner (2010) on grant rates in cases involving business activity is suggestive. Recall that under the theoretical model I present, a fully-informed Court would review any lower Court decision that diverges from the Court median's ideal point. So, assuming that lower court decisions are drawn from a distribution that is similar from year-to-year, the rate of review by a fully informed Court should change only in response to the shift to a shift in the ideological position of the median justice. On the other hand, if the cert pool is potentially influential, a Court on which justices on each side of the median opt out of the pool is expected to have a higher rate of review than a Court on which the cert pool is audited only by a justice on one side of the median—even holding the ideology of the Court median constant. Specifically, if only a liberal justice opts out of the pool, then a set of liberal lower court decisions that would be overturned by a fully-informed Court are left in place.

Conservative business interests had long lamented the reluctance of the Rehnquist court to hear cases related to corporate activity (on this point see, e.g. *The Hands-Off Rehnquist Court* 2005). Could this "reluctance" be due in part to the fact that liberal pool justices colluded with Justice Stevens—the only one out of the pool for most of the Rehnquist court—to leave in place liberal lower court decisions that a fully-informed Court would have reviewed? Epstein, Landes and Posner (2010) show that, compared to the final five years of Rehnquist Court, the Roberts Court granted certiorari in cases related to economic activity at substantially higher rates. 27 percent of cases heard by the Roberts court in its first five terms dealt with business activity, whereas the same rate over the last five years of the Rehnquist court was 21 percent. Furthermore, in economic activity cases where cert was granted, the Roberts court was more likely to review a liberal lower Court decision (68% of reviewed decisions were liberal) than was the Rehnquist court (60% of the reviewed decisions were liberal) (Epstein, Landes and Posner 2010, 1-3).

Change in the identity of the median justice—from Sandra Day O'Connor to Anthony Kennedy—is unlikely to account for this shift. The career Martin-Quinn scores of the two justices are essentially identical.[14] However, the change in review rates coincided not only with a change in the identity of the median member of the Court, but also with the configuration of cert pool. Specifically, during the Roberts court, a conservative justice opted out, for the first time since the Burger Court. The prediction that, as a result, a higher proportion of petitions seeking review of liberal lower court decisions will be granted seems to be supported, at least in one issue area.

Conclusion

In this paper, I have presented the first formal analysis of the Supreme Court cert pool. I find that this institution can influence the set of cases heard by the Court. Unless a justice on each side of the median (or the median herself) opts out of the pool and audits the pool recommendation, lower court policies that a fully-informed Court would change can be left in place. When unaudited, or audited only by an ideological ally, the pool justice who is assigned to make a recommendation in a given case can exploit his informational advantage to leave in a place status quo that he prefers to the Court median's ideal outcome. A central result is that, unless opting out of the pool is too costly, one justice on each side of the median will

[14] Indeed, the Martin-Quinn scores of Kennedy and O'Connor in O'Connor's final term are statistically indistinguishable.

audit the pool, ensuring that all lower court policies revert to the median.

Empirical evidence is consistent with the theoretical predictions of the model. Namely, for the eleven most recent natural courts, the pattern of cert pool participation is as proposed by the equilibrium conditions. Shifts in certiorari grant rates contemporaneous with cert pool membership change are also as expected. Nonetheless, more stringent empirical testing will have to be conducted in order to further validate the model. As well, future work should expand the theoretical framework to account for temporal dynamics. Specifically, the effect of repeating the cert pool game should be modeled. Pertinent questions include, whether in a repeated game, justices will have the incentive to build up a reputation for credibility, leading to more efficient information transmission, and whether the set of equilibria expands or shrinks as justices take into account the effects of future play.

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Appendix

To show that the basic equilibrium results are robust to alternative cost and status quo distribution assumptions, I sketch results demonstrating that a closely analogous equilibrium exits where status quos are drawn from a continuous, uniform distribution and there is a cost to hearing every case.[15] The analysis is parallel to that of the main text. I defer proofs of claims to the next section.

In the model, justice i has ideal point ξ_i with $\xi_5 = 0$. Letting x be the policy outcome, justices have a linear loss utility function, $-|\xi_i - x|$. A cost $k > 0$ is paid by each justice if a case is heard. Status quos are drawn from a uniform distribution with density function $f(x)$ on a subset of the real line $[a, b]$, with $a \leq -2\xi_8 - k$ and $b \geq -2\xi_2 + k$. (Substantively, the constraints on a and b imply that lower courts can announce, with some positive probability, policies that are too liberal (conservative) for the second most liberal (conservative) justice.) A win set is defined as the set of status quos that a justice prefers to leave in place, rather than move to the median: $W(\xi_i) \equiv [-k, 2\xi_i + k]$ for $\xi_i \geq 0$ and $W(\xi_i) \equiv [2\xi_i - k, k]$ for $\xi_i < 0$.

The game structure remains the same: after justices simultaneously decide whether to opt out of the cert pool at a cost of κ, status quo policy x^o is drawn. After the draw, all justices who opted out, and a randomly selected pool justice, observe x^o and send message g or d; upon receipt of the signal(s), all justice vote G or D. If at least four justices vote G, the Court hears the case, policy is moved to ξ_5 and justices receive utility $-|\xi_i| - k$. If three or fewer justices vote G, x^o is left in place, with resultant payoffs $-|\xi_i - x^o|$.

A PBE for the sender-receiver game with one sender is the following: ξ_s sends g iff $x^o \in \complement W(\xi_s)$ and d iff $x^o \in W(\xi_s)$. Upon receipt of g, by consistency of beliefs, justices believe x^o is uniformly distributed on $\complement W(\xi_s)$, and upon receipt of d, that x^o is uniformly distributed on $W(\xi_s)$. Given signal g, a justice ξ_i votes G iff $\text{EL}_i(D|g) > \text{EL}_i(G|g)$, which can be shown to hold for at least four justices ξ_i, for all ξ_s, as long as the constraints on a and b are satisfied (Claim 1). Upon receipt of d, justices believe x^o has uniform density on $W(\xi_s)$, and ξ_i votes D iff $\text{EL}_i(D|d) \leq \text{EL}_i(G|d)$. c^+ and c^- are again defined so that a credible signaler ξ_s is one who is in $[c^-, c^+]$; if, and only if, $\xi_s \in [c^-, c^+]$ does $\text{EL}_i(D|d) \leq \text{EL}_i(G|d)$ hold for at least six ξ_i. Moreover, it can be shown that $\frac{k\sqrt{2}}{2} \leq c^+, |c^-| \leq k$ (Claim 2). Thus, again, a signaler is less likely to be credible, the more extreme he is. By the definition of $W(\xi_i)$, if $x^o \in W(\xi_s)$ the signaler has no incentive to defect and send g, and if $x^o \notin W(\xi_s)$ the signaler can be made

[15] Though it is hard to argue that any one set of assumptions is canonical in the literature, this is one candidate. For example, Lax (2003), in an influential analysis of how the "Rule of Four" for granting cert influences lower court compliance, also uses a linear loss utility function, a constant cost of review, and assumes that lower court case cut-points are uniformly distributed.

no better off by defecting to d.

For two senders, ξ_{s1} and ξ_{s2}, there is the following equilibrium. ξ_{si} sends d iff $x^o \in W(\xi_{si})$ and g otherwise. I list the message of ξ_{s1} first, followed by the message of ξ_{s2}. Upon receipt of g, g, justices believe that x^o is uniformly distributed on $\complement W(\xi_{s1}) \cap \complement W(\xi_{s2})$, and so vote G iff $\text{EL}_i(D|g,g) > \text{EL}_i(G|g,g)$, which can be shown to hold for at least four justices ξ_i, for any ξ_{s1}, ξ_{s2} (Claim 3). Upon receipt of d, d, justices believe x^o is uniformly distributed on $W(\xi_{s1}) \cap W(\xi_{s2})$, and vote G iff $\text{EL}_i(D|d,d) > \text{EL}_i(G|d,d)$. This holds for four or more justices ξ_i iff ξ_{s1} and ξ_{s2} are on the same side of the median, and neither is credible (Claim 4). Upon g, d, justices believe x^o is uniformly distributed on $\complement W(\xi_{s1}) \cap W(\xi_{s2})$, voting G iff $\text{EL}_i(D|g,d) > \text{EL}_i(G|g,d)$, which holds for at least five justices (Claim 5). Again, no signaler can be made better off by a defection from this equilibrium.

As before, it is worth noting that a non-credible justice cannot "imitate" a credible justice in equilibrium, because she cannot commit to *not* sending d for any $x^o \in W(\xi_s)$, for any proposed equilibrium in which her signal d would lead to a collective denial. And again, the extension to N signalers is straightforward: there exists an equilibrium where signalers send d iff $x^o \in W(\xi_s)$, and g otherwise; the Court collectively grants if at least one g signal is sent, or all signalers are on the same side of the median and non-credible—and collectively denies otherwise. Lastly, note that here too, the influence of the cert pool is in letting stand some status quos that a fully-informed Court would collectively prefer to grant. (I.e., a status quo $x^o \notin [-k, k]$.) No status quo that a fully-informed Court would deny is granted.

Turning to the decision to opt out of the cert pool, $\text{EL}_i(\text{In}|\xi_j, \ldots, \xi_n \text{ Out})$, the expected loss to ξ_i for staying in the pool, given that N other justices $\xi_j, \ldots, \xi_n$ opt out is

$$\frac{1}{9-N}\Bigg[\sum_{\substack{\xi_s \neq \xi_j, \ldots, \xi_n, \\ \xi_s \text{ or } \xi_j \text{ or } \ldots \\ \xi_n \in [c^-, c^+]}} \int_{W(\xi_s) \cap W(\xi_j) \ldots \cap W(\xi_n)} |\xi_i - x| f(x) \mathrm{d}x +$$

$$\sum_{\substack{\xi_s \neq \xi_j, \\ \ldots, \xi_n}} \int_{\complement[W(\xi_s) \cap W(\xi_j) \ldots \cap W(\xi_n)]} (|\xi_i| + k) f(x) \mathrm{d}x + \sum_{\substack{\xi_s \neq \xi_j, \ldots, \xi_n, \\ \xi_s, \xi_j, \ldots \xi_n \\ \notin [c^-, c^+]}} \int_{W(\xi_s) \cap W(\xi_j) \ldots \cap W(\xi_n)} (|\xi_i| + k) f(x) \mathrm{d}x\Bigg],$$

and the the expected loss for ξ_i for opting out, given that N other justices $\xi_j \ldots \xi_n$ opt out,

$\text{EL}_i(\text{Out}|\xi_j, \ldots, \xi_n \text{ Out})$ is

$$\frac{1}{8-N}\Bigg[\sum_{\substack{\xi_s \neq \xi_i,\ldots,\xi_n,\\ \xi_s \text{ or } \xi_i \text{ or } \ldots \\ \xi_n \in [c^-,c^+]}} \int_{W(\xi_s)\cap W(\xi_i)\ldots\cap W(\xi_n)} |\xi_i - x| f(x)\mathrm{d}x +$$

$$\sum_{\substack{\xi_s \neq \xi_i,\\ \ldots,\xi_n}} \int_{\complement[W(\xi_s)\cap W(\xi_i)\ldots\cap W(\xi_n)]} (|\xi_i| + k) f(x)\mathrm{d}x + \sum_{\substack{\xi_s \neq \xi_i,\ldots,\xi_n,\\ \xi_s,\xi_i,\ldots\xi_n \\ \notin [c^-,c^+]}} \int_{W(\xi_s)\cap W(\xi_i)\ldots\cap W(\xi_n)} (|\xi_i| + k) f(x)\mathrm{d}x \Bigg].$$

The expected losses for ξ_i for opting in and out, given that no other justice is out, and given that one other justice is out, are also defined by formulas analogous to those in the main text. Letting again κ stand for the cost of opting out of the pool, the equilibria in pure strategies are then:

- No justice opts out, where there exists no ξ_i such that $\text{EL}_i(\text{In}|\text{All In}) - \text{EL}_i(\text{Out}|\text{All In}) > \kappa$

- One ξ_i, such that (1) there exists no ξ_j for whom $\text{EL}_j(\text{In}|\xi_i \text{ Out}) - \text{EL}_j(\text{Out}|\xi_i \text{ Out}) > \kappa$ and (2) $\text{EL}_i(\text{In}|\text{All Out}) - \text{EL}_i(\text{Out}|\text{All Out}) > \kappa$, opts out and all others opt in.

- Any one pair of justices, ξ_i and ξ_j, such that $\text{EL}_j(\text{In}|\xi_i \text{ Out}) - \text{EL}_j(\text{Out}|\xi_i \text{ Out}) > \kappa$ and $\text{EL}_i(\text{In}|\xi_j \text{ Out}) - \text{EL}_i(\text{Out}|\xi_j \text{ Out}) > \kappa$, opts out and all others opt in.

- Any three justices, ξ_i, ξ_j, and ξ_k, such that $\text{EL}_{i(j)(k)}(\text{In}|\xi_{j(k)(i)}, \xi_{k(i)(j)} \text{ Out})$ $-\text{EL}_j(\text{Out}|\xi_{k(i)(j)}, \xi_{j(k)(i)} \text{ Out}) > \kappa$ opt out, and all others opt in.

- Any four justices, ξ_i, ξ_j, ξ_k and ξ_l, such that $\text{EL}_{i(j)(k)(l)}(\text{In}|\xi_{j(k)(l)(i)}, \xi_{k(l)(i)(j)}, \xi_{l(i)(j)(k)} \text{ Out})$ $-\text{EL}_j(\text{Out}|\xi_{j(k)(l)(i)}, \xi_{k(l)(i)(j)}, \xi_{l(i)(j)(k)} \text{ Out}) > \kappa$ opt out, and all others opt in.

Importantly, this set of equilibria is more limited than it may initially appear. Specifically,(as above) it can be shown that no ξ_i will opt out, given that any $\xi_j > 0$ and $\xi_k < 0$ are out of the pool (Claim 6). As well, for any pair ξ_i and ξ_j such that $|\xi_i| > |\xi_j|$ and $\xi_i\xi_j \geq 0$, ξ_i never opts out if ξ_j is out and $\xi_j \in [c^-, c^+]$ (Claim 7), but ξ_i may opt out if ξ_j is out and $\notin [c^+, c^-]$ (Claim 8). In other words, if two justices who are on opposite sides of the median opt out, no other justice will opt out; if the median opts out, all others opt in; and more than one justice on the same side of the median will opt out only if (i) no justice on the opposite side of the median opts out, and (ii) no justice who is out is credible.

In summary, all of the key results translate to a framework where non-meritorious cases have probability 0, and all cases that are heard incur a cost. The only difference of note is that non-median status quos in $[-k, k]$ are not heard by the Court, even when the pool is audited; this is in contrast to the equilibrium in the main text, where all non-median status quos are reviewed by a fully-informed Court.

Proofs of Claims in Appendix

Claim 1. *$EL_i(D|g) > EL_i(G|g)$, for at least four ξ_i, for all ξ_s.*

In the proposed equilibrium, ξ_s sends g iff $x^o \in \complement W(\xi_s)$, so by consistency of beliefs, all $\xi_i \neq \xi_s$ believe x^o is uniform on $\complement W(\xi_s)$ after receipt of g, and vote G iff $\text{EL}_i(D|g) > \text{EL}_i(G|g)$. Assuming with little loss of generality that $\xi_s \geq 0$, this condition is:

$$\int_a^{-k} |\xi_i - x| f(x) \mathrm{d}x + \int_{2\xi_s + k}^{b} |\xi_i - x| f(x) \mathrm{d}x \geq |\xi_i| + k. \tag{1}$$

To make the formulas used below more transparent, call the limits of integration in (1), $A \equiv a$, $B \equiv -k$, $C \equiv 2\xi_s + k$, $D \equiv b$.

Case I. Suppose $\xi_i \in [0, 2\xi_s + k]$. Then, (1) can be written as

$$\left(\frac{B - A}{B - A + D - C}\right)\left(\xi_i - \frac{B + A}{2}\right) + \left(\frac{C + D}{2} - \xi_i\right)\left(\frac{D - C}{B - A + D - C}\right) > \xi_i + k. \tag{2}$$

Algebra and substitution of $-k$ for B demonstrates (2) is satisfied iff

$$\frac{(A + k)^2}{4(D - C)} + \frac{(D + C)}{4} - \xi_i > 0. \tag{3}$$

The left-hand side takes on a minimum where $D - C = -(k + A)$, and with that substitution, more algebra shows (3) and so (2) is certainly satisfied if

$$\frac{C}{2} - \frac{A}{2} - k - \xi_i > 0, \tag{4}$$

or equivalently, if $A < C - 2k - 2\xi_i$. The smallest C can be is k (for $\xi_s = 0$), so (1) is certainly satisfied if ξ_i is in $[0, 2\xi_s + k]$, for $i = 5, 6, 7, 8$.

Case II. Suppose $\xi_i \in (2\xi_s + k, b]$. Then, (1) can be written as:

$$\left(\frac{B - A}{B - A + D - C}\right)\left(\xi_i - \frac{B + A}{2}\right) + \frac{(\xi_i - C)^2}{2(B - A + D - C)} + \frac{(D - \xi_i)^2}{2(B - A + D - C)} > \xi_i + k. \tag{5}$$

Substituting $-k$ for B, and algebra, shows that (5) holds iff A is outside the interval (A^-, A^+), with

$$A^+, A^- \equiv -k \pm \sqrt{4D\xi_i - 2kC + 2kD - C^2 - D^2 - 2\xi_i^2}. \tag{6}$$

Taking a series of partial derivatives shows that A^- is minimized for $C = k$, $D = 2\xi_i + k$, and $k = \xi_i$; then, A^- can be no smaller than $-k - \sqrt{4\xi_i^2}$. It follows that (1) is satisfied if ξ_i is in $[2\xi_s + k, b]$ for $i = 5, 6, 7, 8$.

As all $\xi_i \geq 0$ are covered by Cases I or II, it is clear that if $\xi_s \geq 0$, $\mathrm{EL}_i(D|g) > \mathrm{EL}_i(G|g)$, for at least four ξ_i. The parallel analysis for $\xi_s < 0$ proves the claim. $\square$

Claim 2. *$EL_i(D|d) < EL_i(G|d)$ for at least six ξ_i iff ξ_s is in (c^-, c^+); $\frac{k\sqrt{2}}{2} \leq c^+, |c^-| \leq k$.*

Define c^+ as the smallest positive number that, for at least six ξ_i, satisfies

$$\int_{-k}^{2c^+ + k} |\xi_i - x| f(x) \mathrm{d}x \leq |\xi_i| + k. \tag{7}$$

Define c^- as the greatest negative number that, for at least six ξ_i, satisfies

$$\int_{2c^- - k}^{k} |\xi_i - x| f(x) \mathrm{d}x \leq |\xi_i| + k. \tag{8}$$

In the proposed equilibrium, ξ_s sends d iff $x^o \in W(\xi_s)$, so by consistency of beliefs, all $\xi_i \neq \xi_s$ believe x^o is uniform on $W(\xi_s)$ after receipt of d. With trivial loss of generality, assume $\xi_s \geq 0$. Then, ξ_i votes $D|d$ iff $\mathrm{EL}_i(D|d) \leq \mathrm{EL}_i(G|d)$,

$$\int_{-k}^{2\xi_s + k} |\xi_i - x| f(x) \mathrm{d}x \leq |\xi_i| + k. \tag{9}$$

Case I: Suppose $\xi_i \leq -k$. Then (9) is $\xi_s - \xi_i \leq -\xi_i + k$, which holds iff $\xi_s < k$.
Case II: Suppose $-k \leq \xi_i \leq 0$. Then (9) can be written as

$$\frac{(\xi_i + k)^2}{2(2\xi_s + 2k)} + \frac{(2\xi_s + k - \xi_i)^2}{2(2\xi_s + 2k)} \leq |\xi_i| + k. \tag{10}$$

Algebra yields

$$\xi_s \leq \frac{\sqrt{2k^2 - 4k\xi_i - 2\xi_i^2}}{2}. \tag{11}$$

Note that the right-hand side of (11) is decreasing in ξ_i, so the inequality is certainly satisfied for $\xi_s \leq \frac{k\sqrt{2}}{2}$, and cannot be satisfied for $\xi_s > k$.
Case III: Suppose $0 \leq \xi_i \leq 2\xi_s + k$. Then, (9) again equals (10), and solving for ξ_s gives

$$\xi_s \leq \frac{2\xi_i + \sqrt{2k^2 + 4k\xi_i + 2\xi_i^2}}{2}. \tag{12}$$

The right-hand side of (12) is clearly increasing in ξ_i, so the inequality is certainly satisfied for $\xi_s \leq \frac{k\sqrt{2}}{2}$.
Case IV: Suppose $\xi_i \geq 2\xi_s + k$. Then, $W(\xi_s) \subset W(\xi_i)$ and so $|\xi_i - x| < |\xi_i| + k$ for every $x \in W(\xi_s)$ and therefore (9) clearly holds.

Only ξ_i covered by Cases III and IV have a chance to satisfy (9) when $\xi_s > k$; since only four ξ_i are covered by Cases III and IV, c^+ is at most k. For every Case, (9) is satisfied if $\xi_s \leq \frac{k\sqrt{2}}{2}$, so c^+ is at least $\frac{k\sqrt{2}}{2}$. Clearly, if some ξ_s satisfies (9), so does any other $\xi_s' \in [0, \xi_s]$—and thus every $\xi_s \in [0, c^+]$ is credible. The parallel analysis for $\xi_s < 0$ proves the claim. $\square$

Claim 3. *$EL_i(D|g,g) > EL_i(G|g,g)$ for at least four ξ_i, given any ξ_{s1} and ξ_{s2}.*

In the proposed equilibrium, ξ_{si} sends g iff $x^o \in \complement W(\xi_{si})$. Suppose first that ξ_{s1} and ξ_{s2} are not on opposite sides of the median, and assume without loss of generality that $|\xi_{s1}| \geq |\xi_{s2}|$. Then, since $\complement W(\xi_{s1}) \cap \complement W(\xi_{s2}) = \complement W(\xi_{s2})$, the proof of Claim 1 leads to the result immediately.

Second, suppose ξ_{s1} and ξ_{s2} are on opposite sides of the median, and assume with trivial loss of generality that $\xi_{s1} < \xi_{s2}$. Then, $\complement W(\xi_{s1}) \cap \complement W(\xi_{s2}) \subset \complement W(\xi_i)$ for all $\xi_i \in [\xi_{s1}, \xi_{s2}]$, implying $|\xi_i - x| > |\xi_i| + k$ for all $x \in \complement W(\xi_{s1}) \cap \complement W(\xi_{s2})$; therefore clearly $\mathrm{EL}_i(D|g,g) > \mathrm{EL}_i(G|g,g)$ for all such ξ_i.

So, it only remains to show that when ξ_4 and ξ_6 send g, for a fourth justice ξ_i ($i \neq 4,5,6$), $\mathrm{EL}_i(D|g,g) > \mathrm{EL}_i(G|g,g)$ holds. A proof very closely paralleling that of Claim 1 shows it does, if $a \leq -2\xi_7 - k$ or $b \geq -2\xi_3 + k$. Noting $a \leq -2\xi_8 - k$ and $b \geq -2\xi_2 + k$ completes the proof. □

Claim 4. *$EL_i(D|d,d) > EL_i(G|d,d)$ holds for four or more justices ξ_i iff ξ_{s1} and ξ_{s2} are on the same side of the median, and neither is credible.*

In the proposed equilibrium, ξ_{si} sends d iff $x^o \in W(\xi_{si})$. Suppose that ξ_{s1} and ξ_{s2} are not on the same side of the median. Then, ξ_i votes $G|d,d$ iff $\mathrm{EL}_i(D|d,d) > \mathrm{EL}_i(G|d,d)$,

$$\int_{-k}^{k} |\xi_i - x| f(x) \mathrm{d}x > |\xi_i| + k. \tag{13}$$

But $|\xi_i - x| \leq |\xi_i| + k$ for all $x \in [-k, k]$, for all ξ_i, so (13) never holds. Now suppose that ξ_{s1} and ξ_{s2} are on the same side of the median. Assume with trivial loss of generality that $\xi_{s1} > 0$. Then, ξ_i votes $G|d,d$ iff $\mathrm{EL}_i(D|d,d) > \mathrm{EL}_i(G|d,d)$, which is given by

$$\int_{-k}^{min[2\xi_{s1}, 2\xi_{s2}]+k} |\xi_i - x| f(x) \mathrm{d}x > |\xi_i| + k. \tag{14}$$

It follows straightforwardly from the proof of Claim 2 that (14) holds for at least four ξ_i iff ξ_{s1}, $\xi_{s2} > c^+$ (neither signaler is credible). The parallel analysis for $\xi_{s1} < 0$ proves the claim. □

Claim 5. *$EL_i(D|g,d) > EL_i(G|g,d)$ holds for at least five ξ_i.*

Suppose with trivial loss of generality that $\xi_{s1} > 0$. If $\xi_{s2} > 0$, then $\mathrm{EL}_i(D|g,d)$ is $\int_{2\xi_{s1}+k}^{2\xi_{s2}+k} |\xi_i - x| f(x) \mathrm{d}x$ which is greater than $\mathrm{EL}_i(G|g,d) = |\xi_i| + k$ for all $\xi_i < \xi_{s1}$, since, for all such ξ_i, $|\xi_i - x| > |\xi_i| + k$ for all x in $[2\xi_{s1} + k, 2\xi_{s2} + k]$. And if $\xi_{s2} < 0$, then $\mathrm{EL}_i(D|g,d)$ is $\int_{2\xi_{s2}-k}^{-k} |\xi_i - x| f(x) \mathrm{d}x$, which is $> |\xi_i| + k, \forall \xi_i \geq 0$, since $|\xi_i - x| > |\xi_i| + k$, $\forall x \in [2\xi_{s2} - k, -k]$, $\forall \xi_i \geq 0$. The parallel analysis for $\xi_{s1} < 0$ proves the claim. □

Claim 6. *No ξ_i will opt out, given that any $\xi_j > 0$ and $\xi_k < 0$ are out of the pool.*

For any two justices ξ_j, ξ_k on opposite sides of the median, $W(\xi_j) \cap W(\xi_k)$ is $[-k, k]$. Therefore, for any other ξ_i,

$$\text{EL}_i(\text{In}|\xi_j, \xi_k \text{ Out}) = \text{EL}_i(\text{Out}|\xi_j, \xi_k \text{ Out}) =$$
$$\int_a^{-k} (|\xi_i| + k) f(x)\mathrm{d}x + \int_{-k}^{k} |\xi_i - x| f(x)\mathrm{d}x + \int_k^b (|\xi_i| + k) f(x)\mathrm{d}x.$$

So certainly, ξ_i will not pay κ to opt out. □

Claim 7. *For any pair ξ_i and ξ_j such that $|\xi_i| > |\xi_j|$ and $\xi_i\xi_j \geq 0$, if ξ_j is out and $\xi_j \in [c^-, c^+]$, ξ_i never opts out.*

Suppose with trivial loss of generality that ξ_i and ξ_j are both ≥ 0. Let

$$A \equiv \int_k^{2\xi_j + k} (|\xi_i| + k) f(x)\mathrm{d}x$$

$$B_s \equiv \int_k^{2\xi_s + k} |\xi_i - x| f(x)\mathrm{d}x + \int_{2\xi_s + k}^{2\xi_j + k} (|\xi_i| + k) f(x)\mathrm{d}x$$

$$C \equiv \int_k^{2\xi_j + k} |\xi_i - x| f(x)\mathrm{d}x.$$

Then, $\text{EL}_i(\text{Out}|\xi_j \text{ Out}) - \text{EL}_i(\text{In}|\xi_j \text{ Out})$ is exactly

$$\frac{1}{7}\left(\sum_{\xi_s \leq 0} A + \sum_{\substack{\xi_s \in \\ (0, \xi_j)}} B_s + \sum_{\substack{\xi_s \neq \xi_i, \\ \xi_s \geq \xi_j}} C\right) - \frac{1}{8}\left(\sum_{\xi_s \leq 0} A + \sum_{\substack{\xi_s \in \\ (0, \xi_j)}} B_s + \sum_{\xi_s \geq \xi_j} C\right).$$

Letting m be the number of signalers $\xi_s \in (0, \xi_j)$, this difference can be written as

$$\frac{5}{7} A + \frac{1}{7} \sum_{\substack{\xi_s \in \\ (0, \xi_j)}} B_s \frac{2 - m}{7} C - \left(\frac{5}{8} A + \frac{1}{8} \sum_{\substack{\xi_s \in \\ (0, \xi_j)}} B_s + \frac{3 - m}{8} C\right) = \frac{5}{56} A + \frac{1}{56} \sum_{\substack{\xi_s \in \\ (0, \xi_j)}} B_s - \frac{5 + m}{56} C.$$

$A \geq B_s \geq C$, since $|\xi_i - x| < |\xi_i| + k$ for all $x \in [k, 2\xi_j + k]$, thus $\text{EL}_i(\text{Out}|\xi_j \text{ Out}) - \text{EL}_i(\text{In}|\xi_j \text{ Out}) \geq 0$. So certainly ξ_i will not pay κ to opt out. The parallel analysis for the case of $\xi_i, \xi_j \leq 0$ proves the claim. □

Claim 8. *For any pair ξ_i and ξ_j such that $|\xi_i| > |\xi_j|$ and $\xi_i\xi_j \geq 0$, ξ_i may opt out if ξ_j is out and $\notin [c^+, c^-]$.*

Suppose with trivial loss of generality that ξ_i and ξ_j are both ≥ 0. Now let

$$A \equiv \int_{-k}^{k} |\xi_i - x| f(x) \mathrm{d}x + \int_{k}^{2\xi_j + k} (|\xi_i| + k) f(x) \mathrm{d}x$$

$$B_s \equiv \int_{-k}^{2\xi_s + k} |\xi_i - x| f(x) \mathrm{d}x + \int_{2\xi_s + k}^{2\xi_j + k} (|\xi_i| + k) f(x) \mathrm{d}x$$

$$C \equiv \int_{-k}^{2\xi_j + k} (|\xi_i| + k) | f(x) \mathrm{d}x.$$

Then, $\mathrm{EL}_i(\mathrm{Out}|\xi_j \text{ Out}) - \mathrm{EL}_i(\mathrm{In}|\xi_j \text{ Out})$ is

$$\frac{1}{7}\left(\sum_{\xi_s \leq 0} A + \sum_{\substack{\xi_s \in \\ (0,c^+)}} B_s + \sum_{\substack{\xi_s \neq \xi_i, \\ \xi_s \geq c^+}} C \right) - \frac{1}{8}\left(\sum_{\xi_s \leq 0} A + \sum_{\substack{\xi_s \in \\ (0,c^+)}} B_s + \sum_{\xi_s \geq c^+} C \right).$$

Letting m be the number of signalers $\xi_s \neq \xi_j$ such that $\xi_s \in (0, c^+)$, this difference can be written as

$$\frac{5}{7} A + \frac{1}{7} \sum_{\substack{\xi_s \in \\ (0,\xi_j)}} B_s \frac{2-m}{7} C - \left(\frac{5}{8} A + \frac{1}{8} \sum_{\substack{\xi_s \in \\ (0,\xi_j)}} B_s + \frac{3-m}{8} C \right) = \frac{5}{56} A + \frac{1}{56} \sum_{\substack{\xi_s \in \\ (0,\xi_j)}} B_s - \frac{5+m}{56} C.$$

$C \geq B_s \geq A$, since for all x in $[-k, 2\xi_j + k]$, $|\xi_i| + k > |\xi_i - x|$, and so $\mathrm{EL}_i(\mathrm{Out}|\xi_j \text{ Out}) - \mathrm{EL}_i(\mathrm{In}|\xi_j \text{ Out})$ can be no more than 0. Thus ξ_i pays κ to opt out, for sufficiently small κ. $\square$