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THE IMPLICATIONS OF HIGH COURT DOCKET CONTROL FOR RESOURCE ALLOCATION AND LEGAL EFFICIENCY

Tom S. Clark and Aaron B. Strauss

ABSTRACT

A key source of institutional variation across judicial systems is the degree of control that the highest court has over its docket. Despite this variation, the consequences of various institutional designs in judicial hierarchies remain relatively unexplored by the theoretical literature. In this article, we develop a formal model of high court resource allocation. We analyze the model under two institutional designs: (1) the Court must allocate at least some minimum effort to all cases; (2) the Court has complete discretion over which cases to hear. We analyze the model to identify the optimal allocation of resources across cases as the institutional design varies. We then consider the conditions under which the various institutional rules increase or decrease the legal efficiency, or performance, of the judicial system. Our analysis reveals the complex relationship among the institutional rules governing high court dockets, the design of the judicial hierarchy, and the performance of the legal system. We find that the effect of institutional design on legal efficiency is conditioned by the performance of the lower courts and the incentives for judicial 'shirking' at the High Court. While requiring some per-case effort by the High Court may marginally increase aggregate efficiency, such a requirement causes the High Court to divert resources away from the most difficult cases toward relatively easier cases. The consequence is that more difficult cases are less likely to be decided correctly, while relatively easier cases are more likely to be decided correctly. The model substantively informs policy debates among judicial reformers and scholars concerned with institutional design as well as disciplinary debates about case selection and judicial decision making.

KEY WORDS • docket control • judicial efficiency • resource allocation

During the October 2005 term, 8521 cases were filed in the United States Supreme Court. Of those, the Court selected 87 cases—1 per cent—to give full

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consideration. During the first six months of 2006, the Brazilian Supreme Court, by contrast, considered 55,512 cases. In the United States, the Supreme Court can choose which cases to hear; in Brazil, the Supremo Tribunal Federal must hear all cases that are appealed.

The difference between these two systems highlights a key source of institutional variation across judiciaries. Moreover, it gives rise to an intriguing question: how does discretionary docket control by the highest court in a judicial hierarchy affect the performance of a legal system? On one hand, the US system allows the Court to give careful attention to each case it hears; in this sense, we can say that the 'just' answer is likely to be found in each case heard by the Court. Those cases not heard, however, remain as decided by the court below, regardless of any error in judgment or injustice. On the other hand, the Brazilian system requires each dispute to be addressed by the High Court and therefore mitigates against allowing lower courts' errors to remain uncorrected. Despite the apparent substantial import of such institutional variation in the design of judicial hierarchies, this topic remains a relatively understudied phenomenon in the positive theory of judicial institutions.

In this article, we present a formal model of high court resource allocation. We then use this model to examine the legal efficiency of various institutional designs. We define efficiency as the ability of the judicial system to resolve each legal dispute in a way that conforms with justice and law. Using a variation on the 'knapsack problem' from combinatorial optimization, we seek to demonstrate the conditions under which different institutional designs lead to more or less efficient legal/judicial systems.

1. Introduction

One of the most notable sources of institutional variation across high courts is the degree of control the court has over its own docket. The U.S. Supreme Court has virtually complete control over its own docket. The highest courts in the various states, on the other hand, vary widely in their degree of mandatory versus discretionary dockets (Eisenberg and Miller, 2007). Moreover, there is significant variation internationally in the degree of control that high courts have over their own dockets. For example, in most Latin American countries, the high court – supreme or constitutional – has a virtually mandatory docket, requiring it to hear all (or at least nearly all) cases appealed from the lower courts (see e.g. Navia and Ríos-Figueroa, 2005). Fewer courts have a discretionary docket; they may choose whether or not they will even hear any given case. The U.S. Supreme Court, and many high courts in individual U.S. states, has virtually complete control over its docket. However, the discretionary

docket of the U.S. Supreme Court is unusual from a comparative perspective, and it is itself a relatively recent innovation.[1]

Although little formal theoretical literature examines the specific implications of different institutional rules, variation in high court docket control has been a focus of research and the subject of an important policy debate among legal academics and constitutional scholars (Shelton, 2000; Mills, 2004; Wallace, 2005; Hioureas, 2006). This debate asks whether high courts should have complete discretion over their dockets and seeks to use variation in docket control to explain features of the doctrine developed in particular systems (Couso, 2003; Navia and Ríos-Figueroa, 2005).

Generally out of a concern for growing caseloads, policymakers and practitioners have sought to develop institutional mechanisms for handling the courts' workloads. Principal among the proposals are alternative methods of case resolution that are less demanding on a court's resources. Drawing from his experience in the United States Court of Appeals for the Ninth Circuit, Judge Wallace (2005) observes that alternative methods of dispute resolution – such as mediation and case management – can help alleviate caseload pressures and resource-constraint problems, but notes that these alternatives may come at a price. Specifically, they may affect the quality of judicial decision-making. Notably, though, very few practitioners argue for the US-style system, where the high court has virtually complete discretion to hear a case or not.[2]

Efforts to reform the judicial systems in England and New Zealand reveal that the traditional adherence to mandatory jurisdiction for high courts may be giving way to the pressure of large caseloads and limited resources. Noting these developments, Wallace (2005: 213) observes, 'as more demands are placed on scarce appellate judicial resources throughout the world, more courts are recognizing that case management and mediation efforts are not inimical to due process'. This policy debate has been particularly salient at the European Court of Human Rights, which currently has a backlog of about 30,000 cases and must decide an extraordinary number of cases with limited resources (Shelton, 2000; Hioureas, 2006). There, a report commissioned in 2001 supported proposed reforms that would allow the Court to give varying degrees of consideration to cases, depending on their content (Mowbray, 2002). Moreover, these debates extend to courts other than courts of last resort. In the United States, for example, several states have implemented alternative methods for dealing with

1. The U.S. Supreme Court's discretionary docket is generally identified with the Judges' Bill of 1925, which changed the Court's role from that of final, error-correcting appellate court to that of supervisor, determining the principles and legal rules by which the lower courts are bound (Perry, 1991; Baum, 2001; Buchman, 2003).

2. Of course, the USA is also fairly unusual in that its high court also serves as a constitutional court. In many jurisdictions, these functions are divided, with the constitutional court having a discretionary docket, and the high court of appeals having a mandatory docket.

specific types of cases, aimed at reducing *minimum* resources that a court must spend on a case. During the 1980s, for example, New Jersey implemented an informal arbitration process for dealing with automobile disputes, which significantly reduced court caseload backlog (Maughan, 1985).

Implicit in these debates is a concern for the relationship between the high court and the lower levels of the judicial hierarchy. High courts are appellate courts; they exist to oversee the decisions of the lower courts. A large body of literature has examined how the relationship between the lower courts and the high court affects the way the high court allocates resources to cases (Perry 1991; George, 1999; Cameron et al., 2000; Clark, 2009). Most important is the notion that the quality of the lower courts affects the way the high court should allocate resources. If the lower courts are performing well, then it seems reasonable to allow the High Court to allocate its resources primarily to the most important or most difficult cases. However, if the lower courts perform poorly, then ceteris paribus there is some incentive to require the High Court to review more cases, to ensure better performance of the legal system as a whole (i.e. that more cases are being decided correctly).

One question that emerges from these policy and academic debates focuses on maximizing the efficiency of the legal system. The goal of judicial reformers is to design an institution that allows for the best performance of the courts, in other words, the most cases are decided as well as possible. The consequences of various institutional designs on the performance of the legal system remain unexplored. In this article, we present a formal model of high court docket control that provides insights into precisely this problem: how do different institutional designs affect the performance of the legal system? Our model enables us to examine the effect of various institutional rules on the 'efficiency' of the legal system.

1.1 A Note on Legal Efficiency

Before proceeding with the formal model, we offer a brief note on our concept of legal efficiency. At its core, legal efficiency refers to the ability of the judicial system to ensure correct outcomes in all legal disputes. Scholars have offered different theoretical perspectives on how the judiciary operates, which have different implications for what a 'correct' decision is. Some have argued that the judiciary is primarily a principal–agent institution, characterized by conflicting interests among the different levels of courts (Cameron et al., 2000; Clark, 2009). Another view, predominantly coming from the legal academy, is what may be called a 'team' model (Cameron and Kornhauser, 2005). The team model is characterized by a common interest among all actors in avoiding 'mistakes' and ensuring that each case is disposed of in accordance with some higher goal – 'justice' or 'law'.

In this article, we remain agnostic about which of these two theories better describes any particular judicial system. Within the context of each of these theories, we do assume, though, that there is some 'correct' disposition for each case from the perspective of the High Court. Explicitly, *we assume the High Court has a preference over each case should be decided*. A case decided according to the High Court's preference is a 'correct' decision. An increase in legal efficiency is characterized by an increase in the proportion of cases that are decided correctly (in either an objective legal sense or in an ideological sense). While the concept of 'correct' decisions may seem foreign to many readers, courts expend resources for some purpose. We interpret this purpose as reaching a correct decision, where the correct decision is the decision that would be reached if the court had unlimited time and resources. The motivation behind the correct decision, whether ideological or more noble, and the mechanism that shapes final decisions, whether principal–agent or team, is unimportant for this model.

2. The Model

Our formal model of High Court resource allocation enables us to ask two questions: (1) how does the institutional design of the judiciary affect the way in which the judiciary allocates resources across cases? and (2) how does the institutional design of the judiciary affect the legal efficiency of the judicial system? Two key sources of variation motivate our analysis. First, the quality of the lower judicial system varies. How does the comparison between the discretionary and mandatory dockets change as the quality of the lower courts varies? Second, the distribution of cases varies. How does the comparison between the discretionary and mandatory dockets change as the difficulty of the cases that come before the High Court changes?

2.1 Elements of the Model

The elements our model considers are cases, resources, lower court quality, and decisions and utility.

2.1.1 Cases In the model, there is a set of n 'cases'. A case represents a legal dispute that the High Court is asked to review. Each case is assumed to have a 'correct' legal decision. The Court must consider the cases. Each case has a level of 'difficulty', δ_i, $i = 1, \ldots, n$. Let $\Delta = \{\delta_1, \delta_2, \ldots, \delta_n\}$ represent the vector of case difficulties. We assume that each case's difficulty is a realization of a random variable, $\delta \sim Beta(\alpha, \beta)$. Note that this bounds δ_i between 0 and 1.

The difficulty of each case affects the probability that the Court will reach the correct decision in that case, given a certain amount of effort. In particular, we assume that, *ceteris paribus*, the Court is less likely to find the 'correct' decision in a case as its level of difficulty increases.

2.1.2 Resources When the Court considers a case, it must decide how much effort to expend on that case. We assume that the Court has a fixed amount of resources, E. On each case, the Court must choose how much effort, ε_i, to spend on the case, subject to the constraint that

$$\sum_{i=1}^{n} \varepsilon_i \leq E \tag{1}$$

One of the key comparisons we make concerns the minimum amount of effort the Court may spend on a given case. If the Court can decline to hear a case, then we will require that $0 \leq \varepsilon_i \leq E, \forall i$. If the Court must hear all cases, we will require that $\underline{\varepsilon} \leq \varepsilon_i \leq E, \forall i$.

Finally, we assume that unallocated resources have some positive benefit for the Court. Time not spent considering cases is time that judges can use to pursue other activities – writing scholarly articles, giving speeches, or even golfing. Thus, we assume that after allocating ε_i to each case, the Court receives a benefit

$$\gamma \cdot Log\left(1 + \frac{E - \sum_{i=1}^{n} \varepsilon_i}{E}\right) \tag{2}$$

This quantity is proportional to the log of the percent of unallocated resources; we assume diminishing returns to leisure time. When the court allocates all of its available resources to cases, this quantity is 0. The parameter γ, which we refer to as the 'golfing' parameter, indicates the value the Court places on unallocated resources.

2.1.3 Lower Court Quality A third component of the model is the 'quality' of the lower court system, represented by the parameter q. Substantively, the parameter q represents the ease with which the Court may find the correct decision in a case. That is, given a higher quality of the lower courts, the Court will be more likely to reach a correct decision, given any resource allocation to a given case.[3] Substantively, the higher the quality of the lower courts, the easier the Court finds it to decide cases. More (and better) information is available to the

3. In the context of a judicial hierarchy characterized by principal–agent relationships and adverse selection problems, the parameter q may be thought of as an index of the degree of ideological homogeneity among the levels of the judicial hierarchy.

Court when it hears a case, and the errors or mistakes made by the lower courts are easier to fix. Also, when the Court does not hear a case – i.e., $\varepsilon_i = 0$ – the likelihood is greater that the case is decided correctly. One may also interpret this parameter as an index of preference alignment between the High Court and the lower courts. The more aligned the lower courts are with the High Court, the more likely a lower court's decision is to be aligned with the High Court's preferences and the less effort the High Court will need to expend to ensure a 'correct' decision.

2.1.4 Decisions and Utility The Court hears cases and attempts to identify the correct decision. We have assumed that the probability of identifying the correct decision depends on three parameters: the difficulty of the case, δ_i, the effort the Court spends on the case, ε_i, and the 'quality' of the lower courts, q.

We assume that the probability of finding the correct decision in a case with difficulty δ_i where the Court uses effort ε_i is given by

$$\pi_i(\varepsilon_i; \delta_i, q) = \frac{1}{1 + e^{-((1-\delta_i)\cdot(\varepsilon_i+q))}} \tag{3}$$

While the precise functional form we assume does not substantively matter for our analysis, this function has several desirable features. Note that the function is increasing in q and ε_i, decreasing in δ_i, bounded below by one-half (i.e. the Court does not have less than a 50 percent chance of deciding a case correctly), and bounded above by one. That is, the probability of a correct decision, if the High Court does not hear the case, is at least one half. This, of course, excludes the possibility that cases decided by the lower courts are incorrect with probability greater than 0.5, a situation certainly possible but, in our view, implausible. In addition, the probability that a case is decided correctly strictly increases as the High Court spends more resources on it and as the quality of the lower courts increases. Finally, the probability that a case is decided correctly strictly decreases as the case becomes more difficult. Thus, we choose this functional form because it has substantively reasonable properties. Moreover, the functional form is mathematically appealing, as it is differentiable, continuous, and smooth.

The Court's expected utility from allocating effort ε_i to a case is equal to the probability of deciding the case correctly, multiplied by the difficulty of the case. That is, the Court receives more utility from deciding a harder case correctly than an easier case. The Court's expected utility from allocating resources ε_i to case i with difficulty δ_i is therefore given by

$$EU_i(\varepsilon_i; \delta_i, q) = \delta_i \cdot \pi_i(\varepsilon_i; \delta_i, q) = \frac{\delta_i}{1 + e^{-((1-\delta_i)\cdot(\varepsilon_i+q))}} \tag{4}$$

The Court's goal in the model is to maximize its total utility, of which the efficiency of the legal system is one component. The efficiency of the legal

system is defined by the weighted proportion of cases that are decided correctly. Thus, the Court's total utility is given by

$$EU_C(\varepsilon;\delta,q) = \frac{1}{n}\sum_{i=1}^{n}\frac{\delta_i}{1+e^{-((1-\delta_i)\cdot(\varepsilon_i+q))}} + \gamma \cdot Log\left(1+\frac{E-\sum_{i=1}^{n}\varepsilon_i}{E}\right) \tag{5}$$

and the Court's maximization problem problem can be stated as follows:

$$\max_{\varepsilon} EU_C(\varepsilon;\delta,q) \tag{6}$$

such that equation (1) is satisfied. If the Court's optimal allocation does not use all of its available resources (because, for example, the justices value golfing), then the optimal effort for the *i*th case, ε_i^*, is determined by the solution to

$$\frac{\gamma}{2E-\sum_{i=1}^{n}\varepsilon_i^*} = \frac{\delta_i(1-\delta_i)e^{-((1-\delta_i)\cdot(\varepsilon_i^*+q))}}{n\left(1+e^{-((1-\delta_i^*)\cdot(\varepsilon_i+q))}\right)^2}, \tag{7}$$

which results in a system of equations when there is more than one case on the docket. Even when the court allocates resources between only one case and golfing, this equation has no (known) closed form solution. Therefore, we use an algorithm that solves the generic knapsack problem to calculate the optimal resource allocation.[4]

Finally, this maximization problem raises the possibility that the Court's optimal utility may not maximize legal efficiency, which is given by

$$\frac{1}{n}\sum_{i=0}^{n} EU_i(\varepsilon^*(\delta_i);\delta_i,q), \tag{8}$$

where $\varepsilon^*(\delta_i)$ solves equation (7). We investigate the consequences of this possibility in greater detail late.

2.2 Institutional Designs

In analyzing the model, we seek to compare legal efficiency under alternative institutional designs. As noted, various institutional designs apply to high courts. The primary distinction among the institutional designs is the amount of effort the high court is required to spend on each case. As noted earlier, some courts

4. The knapsack problem is a well-known optimization problem from computer science, whose name derives from fitting a set of discrete items – each with an associated cost and value – into a knapsack with a size constraint. We borrow from solutions to the non-linear knapsack problem, in which non-linear functions represent the items to carry. As in the knapsack problem, we consider a situation with one resource constraint.

must hear all cases that come before them (as in the case of the Brazilian Supremo Tribunal Federal); others may choose not to hear cases and to allow the decision below to stand (as in the case of the U.S. Supreme Court). A third variant on these designs allows the Court to implement alternative dispute resolution mechanisms to dispose of cases with a lower resource requirement. This is the type of institutional mechanism that is at the center of the debate over reform in the European Court of Human Rights (Shelton, 2000; Hioureas, 2006).

We analyze the model here under two different conditions. First, we examine the model when the Court is free to ignore cases and spend no resources on them – when $\underline{\varepsilon} = 0$. Second, we analyze the model when the Court must spend some resources on each case – when $\underline{\varepsilon} > 0$. Comparing the optimal resource allocation and the efficiency of the legal system under these two institutional rules provides insight into the substantive effect of reform of the rules governing the High Court's docket.

3. Analysis

Our model is a non-linear resource-allocation problem – or, a knapsack problem. Several efficient solution methods have been proposed for such problems (Bretthauer and Shetty, 2002). We adopt the multiplier search algorithm developed in Bretthauer and Shetty (1995). Our analysis will proceed in two stages. In the first stage, we examine the Court's allocation of its resources across various types (difficulties) of cases – the value of $\varepsilon^*(\delta_i)$ under the different institutional designs. In the second stage, we compare the legal efficiency that results from the Court's optimal resource allocation across these various institutional designs – equation (8). First, however, we provide a description of the solution concept we employ.

3.1 Solution Concept

The solution concept we employ is based on an algorithm presented in Bretthauer and Shetty (2002) for the non-linear knapsack problem. The knapsack problem is a canonical optimization problem in computer science; here, we apply existing solutions to the judicial resource allocation situation. The overarching logic of the solution is to allocate resources such that each case produces equivalent marginal returns. When the court values unallocated resources (i.e. the justices enjoy golfing), the marginal return on investing effort in deciding cases must balance with the utility loss of lessened leisure time.

The Court must allocate resources among cases that have varying levels of difficulty. First consider the case when the Court does not value unallocated resources (i.e. $\gamma = 0$). The solution concept relies on diminishing returns for the

Court's effort distribution (i.e. the utility function specified in equation (4) is concave with respect to effort, ε_i). The expected utility must also be differentiable. The optimal allocation of the Court's resources is the maximal set of efforts such that the total efforts do not exceed the resource constraint E and that each utility function has the same slope (i.e. marginal utility) as measured at its respective effort. Intuitively, the common slope represents the idea that resources could not be shifted from one case to another and produce larger utility returns. If a minimum amount of effort is required for all cases, as specified by institutional design scenarios 1 and 2, then the common slope that would result from the unconstrained problem may be too high. For these cases, the minimum level of effort produces a rate of return that is smaller than optimal. Resources are shifted to these cases, and the common slope increases because less discretionary effort is spent on the other cases.

When the Court values unallocated resources (i.e. $\gamma > 0$), the solution is modified to ensure that the common slope is not so low that the Court loses total utility from a lack of golf outings. In this situation, the additional constraint is placed on the common slope that the combined value of the increasing returns for deciding cases correctly is greater than the returns on unallocated resources. Formally,

$$\frac{\partial EU_i(\varepsilon_i;\delta_i,q)}{\partial \varepsilon_i} \geq \frac{-n\cdot\gamma}{\left(2E-\sum_{i=1}^{n}\varepsilon_i\right)}, \tag{9}$$

where $\frac{\partial EU_i}{\partial \varepsilon_i}$ is the common slope and the right side of the inequality is the derivative of the utility of unallocated resources (equation (2)). (The derivation of this expression is provided in the Appendix.) In most simulations we have optimized, this additional constraint is the limiting constraint on the common slope and the optimal resource allocation solves the inequality as an equality.

3.2 Basic Comparative Statics

Although there is no closed-form solution to equation (7) (that we are aware of), closed-form expressions of cross-partial derivatives provide insight into the dynamics of the model. We begin by considering the effect of changing the quality of the lower courts on the resources allocated to the case. This effect is found by holding effort for a single case, ε_i, constant and changing the quality of the lower courts, q. We find that increasing the quality of the lower courts reduces the optimal effort to be spent on the case. Formally,

$$\frac{\partial^2 EU_C(\varepsilon_i;\delta_i,q)}{\partial \varepsilon_i \partial q} = \frac{(\delta_i-1)^2\delta_i e^{-((1-\delta_i)\cdot(\varepsilon_i+q))}\left(-1+e^{-((1-\delta_i)\cdot(\varepsilon_i+q))}\right)}{n\left(1+e^{(\delta_i-1)\cdot(\varepsilon_i+q)}\right)^3} < 0 \tag{10}$$

That is, as the quality of the lower courts increases, the Court prefers to spend fewer resources on the case; instead, the Court diverts those resources to 'golfing'.

PROPOSITION 1. *As lower court quality increases, the Court prefers to devote fewer resources to deciding a case; instead it diverts those resources to extra-judicial sources of utility.*

We next consider the effect of the golfing parameter, γ. As one might expect, increasing the value that the Court places on unallocated resources reduces the optimal effort the Court will spend on the case. Formally,

$$\frac{\partial^2 EU_C(\varepsilon_i;\delta,q)}{\partial\varepsilon_i\partial\gamma} = -\frac{1}{2E-\sum_{i=1}^{n}\varepsilon_i} < 0. \tag{11}$$

That is, as the Court places a higher value on unallocated resources (e.g. it enjoys golfing more), the Court will spend less effort on deciding cases.

PROPOSITION 2. *As the value of unallocated resources increases, the Court will devote less effort to deciding cases.*

These two results are highly intuitive. However, the analysis of the model can be extended to a more realistic scenario – one in which the Court is faced with a set of cases of varying difficulty. Under this condition the Court's resource allocation becomes complicated and our analysis sheds light on questions of institutional design.

3.3 Resource Allocation

We first compare the Court's allocation of its resources under the various institutional designs. We seek to demonstrate how variation in the Court's docket control, its value of unallocated resources, and the distribution of case types all affect how much effort the Court allocates to different types of cases. The solution to the model does not lend itself to closed-form solutions on which comparative statics may easily be performed. A clearer and more meaningful method for analyzing the model is to simulate the Court's optimal behavior using the solution concept and to compare the Court's behavior as the exogenous parameters of the model – the minimum resource commitment per case and the quality of the lower courts – change.

Figure 1 shows the optimal amount of effort the Court will spend on a case as a function of the difficulty of the case, under various values of the exogenous parameters. To derive the optimal effort as a function of the case difficulty, we draw a set of 2000 random cases, with $\delta \sim Beta(2,2)$.[5] We also fix the Court's resources at 6000; thus, if the Court allocates its resources completely evenly to

5. This distribution has a lower bound of 0 and an upper bound of 1; it is unimodal around 0.5.

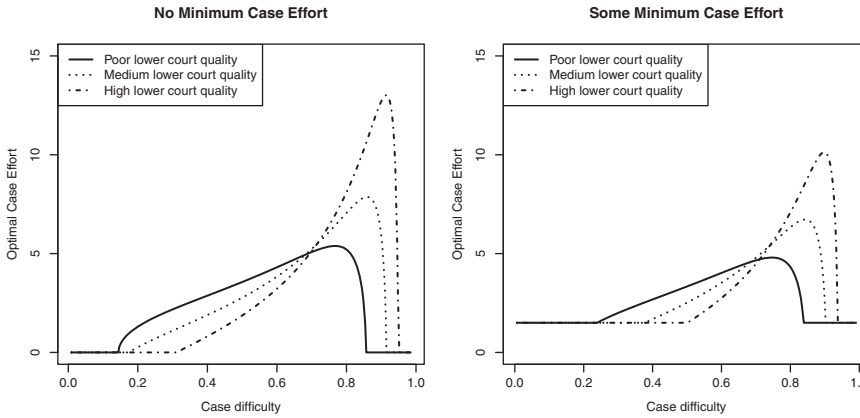

Figure 1. Optimal Effort as a Function of Case Difficulty, by Minimum Required Effort and Quality of the Lower Courts; Effort Calculated Using 2000 Cases with $\delta \sim Beta(2, 2)$ and Total Resources = 6000

all cases, each case will receive an effort of 3.[6] In particular, the left-hand panel shows the optimal effort the Court should spend on a case when it is allowed to ignore cases and spend no effort on them, given three different values of the quality of the lower courts. In the right-hand panel, we see the same results for the scenario where the Court must allocate some minimal amount of resources to each case.

This figure reveals an interesting pattern. First, regardless of the minimal resource allocation requirement, the Court will always spend more resources on cases of moderate difficulty when the lower courts are of poor quality than it will when they are of high quality. That is, given very poor quality lower courts, the High Court will allocate more resources to cases of moderate difficulty than if the lower courts are of higher quality. Importantly, the Court will allocate these resources *at the expense of the most difficult cases*. In particular, as the lower courts become 'better', the High Court will focus more of its resources on higher difficulty cases. That is, the higher the quality of the lower courts, the more resources the Court will spend on the most difficult cases. As the lower courts become 'better', the higher the difficulty of a case must be for the High Court to ignore that case. This finding makes intuitive sense, as the Court will be less willing to risk precious resources on difficult cases if it is uncertain whether or not the lower quality cases are being decided correctly by the lower courts.

6. The total amount of resources we allow for the Court is completely arbitrary and does not affect the comparative statics or qualitative results.

PROPOSITION 3. *As lower court quality increases, the High Court will divert resources away from less difficult cases towards more difficult cases.*

More importantly, though, Figure 1 reveals an interesting difference between the scenario where the Court may ignore some cases and the scenario where the Court must allocate at least some resources to each case. In particular, while the qualitative relationship between the quality of the lower courts and the allocation of resources across the range of case difficulty remains the same, as the minimum required effort per case increases, the Court allocates its resources more evenly across the cases. We see in the right-hand panel of Figure 1 that the minimum effort allocated to each case is higher than in the left-hand panel (because we have exogenously required this) and that, consequently, the maximum effort allocated to a case is *lower*. That is, when the minimum required effort per case increases, the Court spends more resources on cases that previously received the least effort and fewer resources on cases that previously received the most resources.

PROPOSITION 4. *As the required minimum per-case effort increases, the High Court will divert resources from those cases that had received the most effort towards those that had received the least effort.*

These findings are generally intuitive. A casual inspection of the logic of resource allocation suggests that these comparative statics should hold. The real purchase of the model, however, is to compare the performance of the legal system under these various institutional designs. We have seen how the particular allocation of resources changes as the institutional rules change. We begin by considering the allocation of resources across the most difficult cases as a function of the lower courts' quality.

3.4 Lower Court Quality and Resource Allocation

We now consider the amount of effort spent on the most difficult cases as a function of lower court quality. As the lower courts perform better,[7] how does the Court's allocation of resources change? Both analytically and through simulations, we show that under most circumstances, as lower court quality increases, the Court spends more time on more difficult cases.

The basics of the relationship between lower court quality and the Court's effort on difficult cases can understood analytically as well as visually. Assume the Court must decide how to allocate resources between two cases, h and l, with $\delta_h > .5 > \delta_l$. The Court seeks to maximize

7. Or, in the context of a principal–agent framework, as they become more aligned with the High Court.

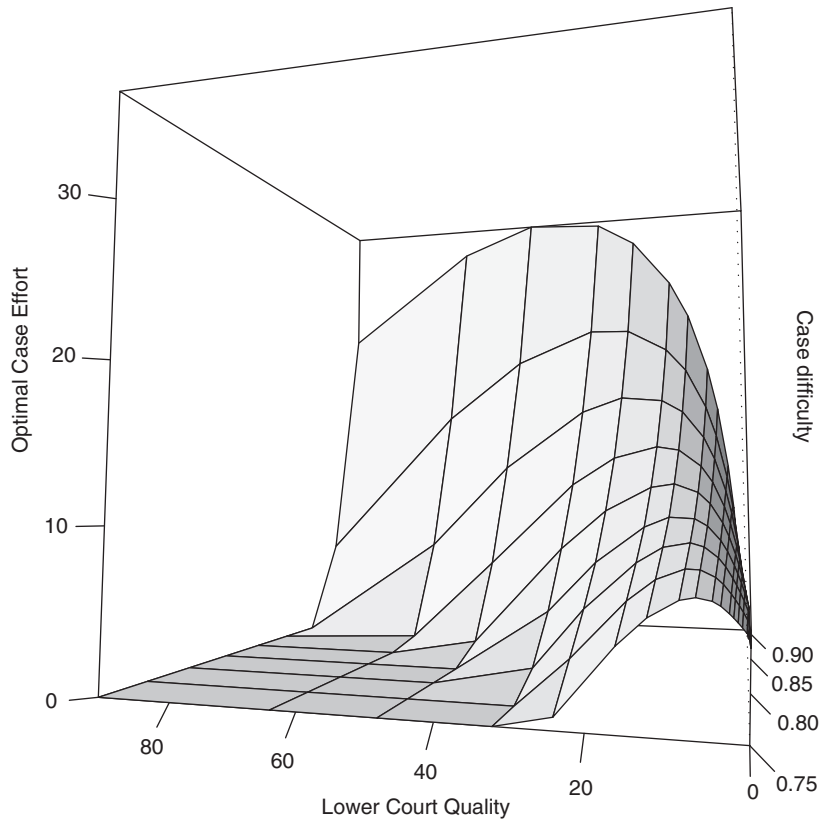

Figure 2. Optimal Effort Spent on Cases, as a Function of Lower Court Quality and Case Difficulty (Most Difficult Cases Only, $\delta \geq 0.75$, Holding Minimum Effort per Case Constant at $\underline{\varepsilon} = 0$; Effort Calculated Using 2000 Cases with $\delta \sim Beta(2, 2)$ and Total Resources = 6000.

$$EU(\varepsilon_{h,l}; \delta_{h,l}, q) = \frac{\delta_h}{1 + e^{-((1-\delta_h)\cdot(\varepsilon_h+q))}} + \frac{\delta_l}{1 + e^{-((1-\delta_l)\cdot(\varepsilon_l+q))}} \tag{12}$$

under the constraint $\varepsilon_h + \varepsilon_l = E$. The quantity of interest is whether the difficulty of the case on which the Court expends the most resources increases or decreases as the quality of the lower court improves. Replacing ε_l with $E - \varepsilon_h$ and taking the partial derivative with respect ε_h, δ_h and q produces

$$\frac{\partial^3 EU}{\partial \varepsilon_h \delta_h q}|_{\varepsilon_h^*, \delta_h^*} = c + k(2z^{\delta_h^* - 1} - (z^{\delta_h^* - 1} - 1)^2), \tag{13}$$

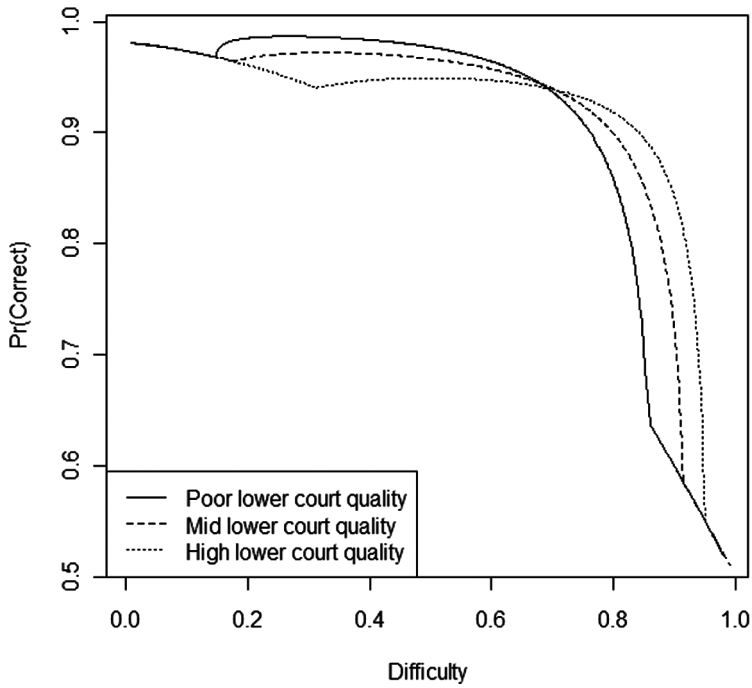

Figure 3. Probability That a Given Case Is Decided Correctly When Optimal Effort is Spent per Case (with No Minimum Effort Required), for Various Values of Lower Court Quality, as a Function of the Case's Difficulty is Effort Calculated Using 2000 Cases with $\delta \sim Beta\ (2, 2)$ and Total Resources = 6000

where c and k are non-negative constants, δ_n^* is the instantion of δ_h^* and $z = e^{(\varepsilon_h + q)}$. As ε_h^* approaches 1, $2z^{\delta_h^* - 1}$ approaches 2, and $(z^{\delta_h^* - 1} - 1)^2$ approaches 0, the cross-partial is positive. The values of q and the distribution of δ_i used in Figure 1 satisfy this relationship. As lower court quality increases, the Court shifts its resources from easier to more difficult cases.

PROPOSITION 5. *As lower court quality increases, the High Court will divert resources away from the easier cases towards more difficult cases.*

This complex relationship between lower court quality and expended effort on difficult cases is illustrated in Figures 1 and 2. The resource peaks in Figure 1 shift toward more difficult cases as lower court quality improves. Figure 2 provides a richer picture: note the allocation of resources when lower court quality is low (at the right-hand end of the front axis in the figure). In this situation, the Court allocates the bulk of its resources to low difficulty cases.

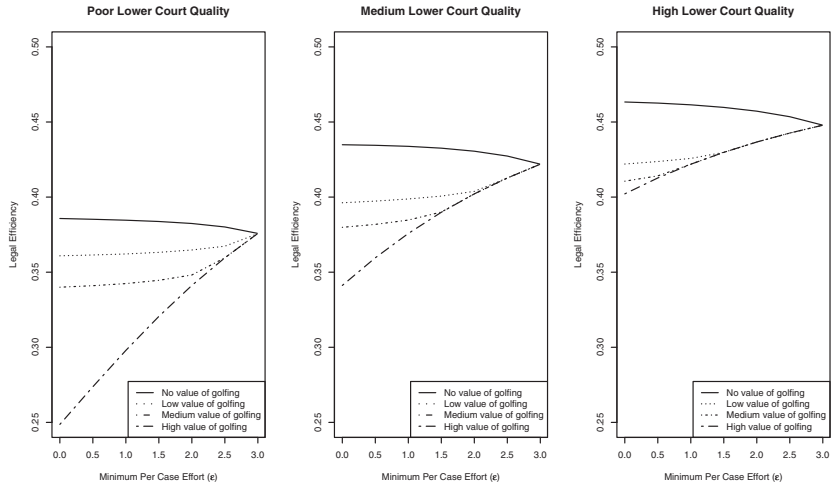

Figure 4. Efficiency of the Legal System as a Function of Minimum Resource Allocation Requirement, by Quality of Lower Courts and 'Golfing' Parameter, γ; Effort Calculated Using 2000 Cases with $\delta \sim Beta(2,2)$ and Total Resources = 6000

By contrast, as the quality of the lower courts increases – as we move to the left on the front axis – the Court shifts its resources toward more difficult cases. In fact, cases that receive a considerable share of the Court's resources when the lower courts are of poor quality (in this example, cases with $\delta \approx 0.80$) receive no effort from the Court when the lower courts are of higher quality (here, $q > 35$). At the same time, the total amount of effort spent on more difficult cases – i.e. $\delta \approx 0.95$ – increases as the lower court quality increases. However, if the lower courts were of extremely high quality, the Court would not expend effort on those more difficult cases ($\delta \approx 0.95$) but would instead spend those resources on still more difficult cases.

Finally, we consider the probability that any given case is decided correctly when there is no minimum effort per case required – i.e. when the Court is free to choose which cases to hear. Figure 3 shows the probability that a case is decided correctly with optimal resource allocation, given three different lower court qualities, as a function of case difficulty. The left side of the figure demonstrates the probability of a correct decision when the Court allocates no resources to a case (corresponding to the range of cases on the left side of the left panel in Figure 1). Regardless of lower court quality, the probability of a correct decision decreases with the difficulty of the case. Then, moving left to right across the figure, when the Court allocates resources to the case, the probability of a correct decision rapidly increases. For cases of moderate difficulty, the probability of a correct decision is greatest when the lower courts are of poor quality. This finding follows from the results in Figure 1, which shows that when the lower courts are of poor

quality, the High Court allocates the most resources to cases in the middle of the range of difficulty. However, as the difficulty of the case increases, this pattern reverses: probability of a correct decision among the hardest cases is greatest with high-quality lower courts and lowest with poor-quality lower courts. Again, this pattern follows from the finding in Figure 1.

PROPOSITION 6. *Decreasing lower court quality decreases the probability of a correct decision among the hardest cases but increases the probability of a correct decision among easier cases.*

3.5 Legal Efficiency

To explore the legal efficiency component of the Court's utility, we compare the legal efficiency that follows from each of the institutional designs, while the Court maximizes its total utility. Specifically, we compare equation (8) under various values of the model's exogenous parameters – competing institutional designs.

Figure 4 shows the total legal efficiency as a function of the minimum resource allocation requirement for different values placed on unallocated resources.[8] When the Court does not place much value on unallocated resources (i.e. $\gamma = 0$), the effect of imposing minimum resource allocation requirements – of making the Court spend at least some effort on each case – has a monotonically negative effect on legal efficiency. That is, when judges do not value unallocated resources, requiring them to spend at least some time on all cases has a deleterious effect on the performance of the legal system. This occurs because, as shown in Figure 1, the Court must shift resources that it would prefer to spend on difficult cases toward less difficult cases. The Court gets a relatively smaller return on its resources when it must spend time on cases that would otherwise be left to the lower courts.

However, when the Court places weight on unallocated resources (i.e. $\gamma > 0$), minimum resource allocation requirements can ameliorate the loss in legal efficiency engendered by judicial 'shirking'. Figure 4 shows that for 'low', 'medium', and 'high' values of γ, there is a positive relationship between the minimum per case effort, $\underline{\varepsilon}$, and legal efficiency – the weighted average proportion of cases decided correctly. Whenever the High Court is faced with an incentive to shirk, requiring the Court to spend more effort on every case has a positive effect on legal efficiency. This is true regardless of the quality of the lower courts.

The quality of the lower courts does alter the marginal effect of the golfing parameter, however. As lower court quality increases, so does the deleterious

8. We again perform this simulation with a set of 2000 random cases with $\delta \sim Beta(2, 2)$ and total resources = 6000 (3 per case).

effect on public utility from a High Court shifting from not valuing leisure time to placing a small value on activities such as golfing. This point is illustrated by the increasing gap between the upper two lines of each panel of Figure 4. When the lower courts are of high quality, the High Court has a greater incentive to shirk.

By contrast, high-quality lower courts ameliorate the deleterious effect of shirking on legal efficiency. Measured at large values of laziness, the marginal effect of increasing the High Court's leisure value decreases as lower-court quality increases. This point is illustrated by the decreasing gap between the bottom two lines in each panel in Figure 4 as lower-court quality increases. The public can rely on high-quality lower courts to counterbalance the negative effects of lazy judges. By extension, the magnitude of the positive impact on legal efficiency of mandating a minimum effort per case (given that the Court values unallocated resources – i.e. $\gamma > 0$) decreases as the quality of the lower courts increases. Very lazy Courts leave many cases decided incorrectly. Some of these cases can be 'corrected' by either requiring the Court to allocate some resources to them or by increasing the quality of the lower courts. Thus, changes in the quality of the lower courts lessens the impact of any marginal increase in the minimum effort the Court must spend on each case (and vice-versa).

PROPOSITION 7. *Increasing the quality of the lower courts decreases the marginal impact of additional devoting resources to any given case. Increases in lower-court quality thus reduce the impact of increases in the High Court's value for unallocated resources and judicial shirking.*

4. Discussion and Conclusion

A significant source of variation in the design of judicial institutions is the degree to which the High Court controls its docket. However, the precise consequences of this institutional variation remain largely unexplored in the theoretical literature. Borrowing from the computer science literature, we have proposed a resource-allocation model of High Court docket control. Faced with a set of cases, the High Court must decide how much of its resources to allocate to each case, subject to various institutional rules prescribing the minimum effort that must be expended on each case. We have analyzed the Court's optimal allocation of resources under these various rules, considering the possible incentive for judicial 'shirking'. The model indicates that requiring at least some attention to each case improves legal efficiency only when there is an incentive for judicial shirking. Moreover, the marginal benefit of such an institutional rule depends on other factors, such as the quality of the lower courts.

The results described here speak to several substantive debates in the literature. Most directly, the model informs the ongoing policy debate among judicial

reformers and institutional design theorists about the degree of control to give High Courts over their dockets. Judicial reformers have debated the merits of various alternative institutional rules. In particular, three institutional rules dominate the reform debate. First, courts may be given complete discretion over which cases to hear (as in the U.S. Supreme Court). This design means that many cases will never be considered by the High Court and the risk of injustice in any given case therefore increases. Second, courts may be required to give full consideration to each and every case that come before them (as in the Brazilian Supremo Tribunal Federal). This design can cause several significant problems, not the least of which is a large backlog in the Court's business. Third, a middle ground may be struck where cases are given partial consideration or referred to alternative dispute resolution (as in some U.S. states). It remains to be seen, though, whether these reforms improve the performance of the judicial system. The model developed here is most instructive on the relative consequences of these institutional rules.

The model suggests that the direction and marginal benefit of docket control reforms depend critically on the context in which they are imposed. Thus, proposals to reform over-worked courts, such as the European Court of Human Rights, should carefully consider the incentives for judicial shirking and the effect of preference alignment and quality across the judicial hierarchy. Our analysis indicates that imposing a minimum per-case effort requirement on the High Court means that resources will be distributed more evenly across cases (see the flattening of the curve in Figure 1) but that this evening of the resources comes at the expense of the most 'difficult' cases (notice the decreased effort given to the hardest cases in Figure 1). To the extent that the 'difficult' cases are the most valuable in our model, this implies that by requiring the Court to pay at least some attention to all cases, this institutional rule diverts judicial attention away from the most important legal disputes.

At the same time, though, the analysis indicates that requiring additional per-case effort by the Court improves legal efficiency *when the Court values unallocated resources*. Scholars have written extensively on the incentive to 'shirk' facing judges, and the problem of requiring actors to perform their duties has been well explored in the organizational economics literature. Our analysis yields an intuitive, but instructive, lesson. While requiring the Court to allocate at least some resources to every case diverts some attention away from the most difficult cases, this requirement always improves legal efficiency when judges value unallocated resources. However, the *marginal* benefit of increasing the minimum per case effort decreases as the quality of the lower courts increases. This relationship highlights an important – and generally unappreciated – component of the judicial reform debate. When the judicial hierarchy as a whole is of sufficiently high quality, the marginal benefit of requiring the High Court to review all cases is much smaller than when the lower courts are of poor quality.

Our analysis also informs disciplinary debates about case selection and judicial decision-making. The analysis provides some insight into which types of cases are most likely to be selected for review when the Court has complete control over its docket and which cases are likely to receive full consideration when the Court has low-resource options (such as alternative dispute resolution) at its disposal. For instance, increasing the quality of lower courts would lead the High Court to exhaust more resources on the important, difficult cases (Figure 1 and Proposition 3). Identifying which cases will be heard has implications for the empirical study of judicial decision making (Kastellec and Lax, 2008); having a theoretical expectation of which cases will make it onto the Court's docket is useful to scholars. Indeed, the existing research on case selection has investigated the effects of various case characteristics on the decision by a court with a discretionary docket to hear a case (Perry, 1991; Cameron et al. 2000; Clark, 2009). In this vein, we have highlighted additional factors that influence that decision, including case characteristics and institutional design. To be sure, we have considered only a single dimension of case characteristics – difficulty. The difficulty parameter analyzed in the model may be interpreted in various ways – ideological background, substantive area of law, legal or political salience and so on. However, it seems most plausible that the various, multiple features of cases all affect the benefit associated with deciding those cases; future analyses might consider how those various case characteristics interact.

Despite the lessons of this analysis, additional investigation is warranted. First, future research may consider the implications of variation in judicial institutional design in the context of the political environment. How might the relationship between the judiciary and the elected branches affect the relative merits of various institutional designs? For example, how might variation in judicial independence affect our interpretation of the golfing parameter? How might the method of selecting of judges affect the Court's objective function? Second, our model does not consider the consequences of internal court dynamics for resource allocation. We have modeled the High Court as a unitary actor. Research on the U.S. Supreme Court (Epstein and Knight, 1998; Caldeira et al., 1999), however, suggests that internal court dynamics may also affect the decision to grant discretionary review to a case. Future theoretical work might improve the richness of our analysis by incorporating such dynamics into this framework. Third, future research may seek to bring empirical evidence to bear on the theoretical predictions generated here. The difficulty of obtaining comparable cross-national measures can be overcome by empirical scholars focused on comparative law and courts. For example, perhaps surveys of public confidence in the courts or satisfaction with the legal system may be used as proxy measures for 'legal efficiency'. In any event, further investigation of the effects of variation in the institutional design of judicial hierarchies seems inherently interesting and potentially consequential, and it strikes us as a promising avenue for scholarship.

Technical Appendix: The Derivation of Equation (9)

The derivative of the court's utility, specified in Equation (5) with respect to ε_i is,

$$\frac{1}{n}\frac{\partial EU_i(\varepsilon_i;\delta_i,q)}{\partial \varepsilon_i}+\frac{\gamma}{\left(2E-\sum_{i=1}^{n}\varepsilon_i\right)}. \tag{14}$$

If a local maximum is present, the solution occurs when the derivative is zero,

$$\frac{1}{n}\frac{\partial EU_i(\varepsilon_i;\delta_i,q)}{\partial \varepsilon_i}+\frac{\gamma}{\left(2E-\sum_{i=1}^{n}\varepsilon_i\right)}=0. \tag{15}$$

Algebra produces the equality version of Equation (9),

$$\frac{\partial EU_i(\varepsilon_i;\delta_i,q)}{\partial \varepsilon_i}=\frac{-n\cdot\gamma}{\left(2E-\sum_{i=1}^{n}\varepsilon_i\right)}. \tag{16}$$

If a local maximum is not present, then resources are fully allocated, and it must be the case that judicial efforts are producing benefits greater than their cost, or,

$$\frac{\partial EU_i(\varepsilon_i;\delta_i,q)}{\partial \varepsilon_i}>\frac{-n\cdot\gamma}{\left(2E-\sum_{i=1}^{n}\varepsilon_i\right)}, \tag{17}$$

The combination of the above two expressions is Equation (9). Mathematically, large enough values of γ may exist such that the court optimally exerts no effort on cases. Though this situation is highly implausible, it would violate the preceeding logic and Equation (9).

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TOM S. CLARK is Assistant Professor of Political Science at Emory University, where he researches judicial decision-making and democratic political institutions. ADDRESS: Department of Political Science, 327 Tarbutton Hall, 1555 Dickey Drive, Emory University, Atlanta, GA 30322, USA [e-mail: tom.clark@emory.edu]

AARON B. STRAUSS is a Senior Analyst at the Mellman Group, where he advises Democratic campaigns and progressive organizations. He has a Ph.D. from Princeton University. ADDRESS: Mellman Group, 1023 31st St. NW, Fifth Floor, Washington, DC 20007, USA. [email:astrauss@mellmangroup.com]