

AN EMPIRICAL ANALYSIS OF HABEAS CORPUS:
THE IMPACT OF *TEAGUE V. LANE* AND THE
ANTI-TERRORISM AND DEATH PENALTY ACT
ON HABEAS PETITION SUCCESS RATES AND
JUDICIAL EFFICIENCY

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INTRODUCTION

Habeas corpus doctrine, like most of American law, has and continues to undergo refinement since its inclusion in the original United States Constitution.¹ Over the last several decades, the United States Supreme Court (the “Supreme Court”) and the United States Congress (“Congress”) have embarked upon a series of attempts to curb the writ. A succession of restrictive Supreme Court decisions, followed by the Antiterrorism and Effective Death Penalty Act (“AEDPA”) of 1996,² were intended to limit the availability of habeas relief, streamline the filing

* For their insightful comments, advice, and support, the author wishes to thank Professors Trevor Morrison and Theodore Eisenberg of Cornell Law School.

¹ U.S. CONST. art. I, § 9, cl. 2.
² 104 P.L. 132; 110 Stat. 1214.

and disposal of habeas petitions, and reduce the number of frivolous habeas filings.

This note employs interrupted time series analysis to investigate the impact of the *Teague v. Lane*³ retroactivity doctrine announced in 1989, and AEDPA, which are widely regarded as being among the most severe curtailments of habeas corpus relief of the last three decades. More specifically, this note evaluates the empirical impact of these two turning points on (a) the success rates of habeas petitions, (b) habeas petition filing rates, and (c) the efficiency of courts in disposing of both meritorious and meritless claims.

This note's findings suggest that, contrary to most scholars' characterization of *Teague* as severely restrictive, the Supreme Court's retroactivity doctrine has not resulted in a decreased probability of successfully obtaining habeas relief. Furthermore, the permanent increase in the time required to dispose of meritless claims following *Teague* indicates that *Teague*'s retroactivity doctrine undermines judicial efficiency by spawning a new set of issues and standards that are difficult to apply. The findings also indicate that AEDPA permanently decreased the probability of obtaining habeas relief but failed to accomplish its objective of streamlining and expediting habeas litigation.

Section I explains the significance of the *Teague* holding and the key provisions of AEDPA in the context of the habeas regimes preceding *Teague* and AEDPA. Section II provides a conceptual framework for analyzing the empirical impact of *Teague* and AEDPA and discusses alternative hypotheses for their causal relationships to judicial efficiency and the availability of habeas relief. Section III describes the data, sources, and steps taken to make the data suitable for analysis. Section IV explains the empirical methodology. Section V describes the models estimated and briefly discusses the estimation results. Section VI provides a detailed interpretation of the estimation results.

I. A BRIEF HISTORY OF HABEAS CORPUS

The writ of habeas corpus allows a prisoner to obtain immediate relief from unlawful confinement by challenging the constitutionality of his or her conviction and sentence. The writ, which is inherited from the central courts of medieval England,⁴ is such a deeply valued legal tradition that the framers incorporated the writ into the United States Constitution. The Suspension Clause of the United States Constitution provides that "The privilege of the Writ of Habeas Corpus shall not be

³ *Teague v. Lane*, 489 U.S. 288 (1989).

⁴ LARRY W. YACKLE, *FEDERAL COURTS: HABEAS CORPUS* 9–10 (Foundation Press 2003).

suspended, unless when in Cases of Rebellion or Invasion the public Safety may require it.”⁵ In 1867, Congress extended the availability of habeas corpus, which previously benefited federal prisoners only, to state prisoners, and granted federal courts jurisdiction to grant habeas relief to both federal and state prisoners.⁶ Today, any inmate may file a petition for a writ of habeas corpus after first challenging his or her conviction through the appeals and post-conviction relief processes in the intermediate appellate and highest court in the state where he or she was convicted.

Because the history of habeas corpus doctrine has been well documented, this note provides only a brief overview of key developments in (a) the standard of review, (b) the retroactivity doctrine, and (c) filing restrictions to provide a context for analysis.

A. STANDARD OF REVIEW

Prior to AEDPA, under *Brown v. Allen*, federal courts applied a de novo standard of review to state court interpretations of questions of federal constitutional law.⁷ At that time, federal courts could review state court adjudications on federal questions, even if the state court’s adjudication of those legal claims was full and fair.⁸ In contrast, AEDPA mandates a higher degree of deference to state court determinations. AEDPA provides that federal habeas relief will not be granted with respect to any claim that was adjudicated on the merits in state court proceedings unless the adjudication of that claim “resulted in a decision that was contrary to, or involved an unreasonable application of, clearly established Federal law, as determined by the Supreme Court,” or was based on “an unreasonable determination of the facts.”⁹ This provision is likely to generate wasteful litigation over a new set of questions that add little value. For example, what is an “unreasonable application” of federal law? What is an “unreasonable determination” of facts? Is a factual finding by a prior court unreasonable if it is merely wrong? The difficulty in addressing these questions is illustrated by the Supreme Court’s fragmented opinion in *Williams v. Taylor*,¹⁰ in which the Court provided several definitions of “unreasonable.”

⁵ U.S. CONST. art. I, § 9.

⁶ 14 Stat. 385 (1867).

⁷ *Brown v. Allen*, 344 U.S. 443, 462–63 (1953).

⁸ *See id.*

⁹ 28 U.S.C. § 2254(d) (2005).

¹⁰ *Williams v. Taylor*, 529 U.S. 362 (2000).

B. RETROACTIVITY

In *Linkletter v. Walker*,¹¹ the Supreme Court announced that the U.S. Constitution neither prohibits nor requires the retroactive application of new rules, and that a reviewing court must “weigh the merits and demerits in each case by looking to the prior history of the rule in question, its purpose and effect, and whether retrospective operation will further or retard its operation.”¹²

Linkletter remained the retroactivity regime until *Teague* was announced in February 1989. *Teague* held that new rules would no longer apply to habeas petitions challenging convictions that became “final” after the announcement of the new rule.¹³ First, a new rule should apply retroactively if it “places certain kinds of primary, private individual conduct beyond the power of the criminal law-making authority to proscribe;” second, a new rule should be applied retroactively if the rule requires observance of “those procedures that . . . are implicit in the concept of ordered liberty.”¹⁴

Teague defines a “new rule” as any rule that is not “dictated by precedent existing at the time the prisoner’s conviction becomes final.”¹⁵ Following *Teague*, the Supreme Court has defined “dictated” as that which is compelled as a matter of logical deduction from the precedent’s holding, which includes only the “material” facts and result of the prior case.¹⁶ Just as *Teague* bars a federal habeas court from entertaining a claim that rests on a recent Supreme Court decision announcing a new rule, *Teague* equally bars a habeas court from itself fashioning a new rule and then applying that rule to resolve a prisoner’s pending claim.¹⁷ A district court’s application of even a settled rule of law to the facts of an analogous case may also “involve a new rule,”¹⁸ since even settled law can be extended if it is applied in a “novel setting.”¹⁹

Even an expansive interpretation of “new rule,” at least in theory, should not decrease the availability of habeas relief permanently; it should merely delay the full realization of both favorable and unfavorable new rules. Despite this logical conclusion, critics argue that the

¹¹ See 381 U.S. 618, 629 (1965).

¹² See *id.*

¹³ A conviction becomes “final” on the date on which the Supreme Court denied certiorari on direct review or, if no petition for certiorari was filed, the date on which the time for filing a petition expired. *Griffith v. Kentucky*, 479 U.S. 314, 321 n.6 (1987).

¹⁴ *Teague*, 489 U.S. at 311.

¹⁵ *Id.* (emphasis in the original).

¹⁶ See generally Linda Meyer, “Nothing we say matters”: *Teague and the New Rules*, 61 U. CHI. L. REV. 423 (1994).

¹⁷ YACKLE, *supra* note 4, at 81.

¹⁸ *Id.* (citing *Sawyer v. Smith*, 497 U.S. 227, 234 (1990)).

¹⁹ YACKLE, *supra* note 4, at 81 (citing *Stringer v. Black*, 503 U.S. 222, 228 (1992)).

Court's expansive interpretation of "new rule" significantly restricts the capacity of federal courts to adjudicate habeas claims because *Teague's* "dictated by precedent" test is "virtually impossible to satisfy,"²⁰ and thus bars federal courts from entertaining claims based even on legal principles that are not genuinely new in any ordinary sense.²¹

C. LIMITATIONS ON FILINGS

Prior to AEDPA, there was no statute of limitations on habeas petitions. A prisoner could file a habeas petition even several years after his or her conviction became final. AEDPA imposes a 180-day filing limitation on prisoners under a sentence of death, and a one-year limitation on all other federal and state prisoners.²² This statute of limitations begins to run when the prisoner's conviction becomes "final."²³ In addition, AEDPA eliminates a federal court's discretion to choose to hear a claim in a successive application that was also presented in a prior application, mandating dismissal, with limited exceptions.²⁴ Both of these AEDPA provisions aim to streamline habeas corpus by encouraging the consolidation of all claims into a single petition and eliminating abuse of the petition process by prisoners. Prior to the adoption of AEDPA, prisoners on death row could postpone filing frivolous habeas petitions and file several successive petitions to delay imposition of their death sentence.

Although AEDPA aimed to streamline the habeas corpus process and to reduce the number of frivolous petitions, AEDPA has produced no impact on filing rates to date, with the exception of a temporary spike in filings per prisoner 12 months after AEDPA's enactment when prisoners rushed to file petitions in order to benefit from law of the pre-AEDPA regime.²⁵ In addition to producing no benefit in terms of reducing frivolous filings, critics of AEDPA suggest that its notoriously poor drafting and complex set of standards might *decrease* efficiency in litigating habeas claims.

It is rank foolishness to think that lawyers and courts, not to mention prison inmates proceeding pro se, can digest and apply the new rules in any sensible, predictable way. AEDPA thus promises ever more frustration. The

²⁰ Meyer, *supra* note 16, at 424.

²¹ See, e.g., Richard H. Fallon, Jr. & Daniel J. Meltzer, *New Law, Non-Retroactivity, and Constitutional Remedies*, 104 HARV. L. REV. 1731, 1748–49 (1991); Ann Woolhandler, *Demodeling Habeas*, 45 STAN. L. REV. 575, 638–44 (1993).

²² See 110 Stat. 1214, §105.

²³ See *id.*

²⁴ See 28 U.S.C. §2244(b).

²⁵ See Fred L. Cheesman, Brian J. Ostrom, & Roger A. Hanson, *A Tale of Two Laws Revisited: Investigating the Impact of the Prisoner Litigation Reform Act and the Antiterrorism and Effective Death Penalty*, NATIONAL INSTITUTE OF JUSTICE, 64 (2004).

new standards hold out the hope that a few prisoners may be able to satisfy their considerable demands and thus invite many desperate prisoners to try. That, of course, crowds federal dockets with cases requiring litigation over threshold procedural issues. At the same time, the new standards are so demanding that almost all the prisoners who make the attempt will fail.²⁶

II. CONCEPTUAL FRAMEWORK AND HYPOTHESES

Among the competing policy goals of habeas doctrine are those of general allocative efficiency and mechanical efficiency—although mechanical efficiency is a form of allocative efficiency, for the purposes of this discussion, it will be useful to distinguish between the two. General allocative efficiency refers to how well scarce judicial and governmental resources are allocated to their most beneficial uses. Thus, decreasing the filing of frivolous claims enhances allocative efficiency by freeing up scarce judicial and governmental resources to be allocated to more beneficial activities, such as expeditiously litigating meritorious claims or mediating settlement. Mechanical efficiency, in contrast, refers to the speed with which claims already in the judicial system are disposed of through judgment, dismissal, settlement, or otherwise. For example, mechanical efficiency can be enhanced by the announcement of a new standard or test that aids courts in dismissing clearly frivolous habeas petitions.

There are two basic measures of judicial efficiency in the habeas corpus context. First, the habeas petition filing rate (the “Habeas Filing Rate” or the “Filing Rate”), or number of filings per prisoner, can measure changes in allocative efficiency of the policy regime. If a new rule is effective at discouraging frivolous habeas filings, a decrease in the Filing Rate would follow the enactment of that new rule. The second measure of efficiency is the time required to dispose of a habeas petition, measured by the time between filing and termination through judgment, dismissal, or otherwise. Henceforth, the average time required to dispose of a habeas petition will be referred to as the “Disposal Time.” This serves as a proxy for mechanical efficiency, since it indicates the effectiveness of the judicial system in disposing of claims that have already entered the litigation process.

These measures are not without limitations, and they can lead to erroneous inferences when examined separately or out of context. An apparent decrease in mechanical efficiency, suggested by an increase in the Disposal Time, may actually signal an increase in general allocative

²⁶ See Larry W. Yackle, *The Figure in the Carpet*, 78 TEX. L.R. 1731, 1741 (2000).

efficiency, or vice versa. For example, general allocative efficiency may be enhanced by a new rule of law that discourages frivolous filings; if fewer frivolous claims are filed, a greater percentage of the claims that are filed will be meritorious, and thus will require more time to dispose of.²⁷ In this scenario, mechanical efficiency will *appear* to have declined because of the increase in the Disposal Time, even though allocative efficiency has increased. In other words, it would require more time to dispose of a habeas petition, on average, for reasons having nothing to do with the court's competence, but rather, having to do with the composition of the petitions filed. Thus, the Disposal Time is not a perfect proxy for mechanical efficiency. However, as long as changes in the Disposal Time, the Filing Rate, and the "Success Rate" (the percentage of habeas petitions that result in a judgment for the petitioner) are analyzed jointly, these measures can be relied on to assess the impact of *Teague* and AEDPA on judicial efficiency.

A. HYPOTHESES REGARDING THE CONSEQUENCES OF THE *TEAGUE* RETROACTIVITY DOCTRINE

The *Teague* retroactivity doctrine could have either increased or decreased efficiency. *Teague* may have caused a decrease in the Disposal Time because, in theory, courts are now obligated to hold that new rules do not apply rather than adjudicate claims under new rules, after determining whether new rules pass the *Linkletter* test for retroactivity.²⁸ The contrary impact on the Disposal Time is equally logical; *Teague* may have merely replaced time formerly devoted to adjudicating the merits with litigation over which rules are "new rules" and whether *Teague's* limited exceptions apply.

There is a general consensus among legal scholars that *Teague* severely restricted the ability of federal courts to grant habeas relief because of its expansive definition of "new rule."²⁹ If this hypothesis is correct, *Teague* should have resulted in either a decrease in the Success Rate or a decrease in the Filing Rate, or both. If prisoners were unresponsive to *Teague*, the Filing Rate would remain constant but fewer claims would succeed, since at least some claims filed would involve novel factual situations that depend on a new rule. However, if prisoners responded to the greater difficulty in obtaining habeas relief by refraining from filing when their claim depended on a new rule, there might be little

²⁷ Successful habeas petitions have a higher Disposal Time than unsuccessful petitions, suggesting a positive correlation between Disposal Time and the merits of a petition. *See infra* § III.

²⁸ *Linkletter v. Walker*, Warden, 381 U.S. 618 (1965).

²⁹ *See, e.g., YACKLE, supra* note 4, at 88; FALLON & MELTZER, *supra* note 21, at 1748-49; WOOLHANDLER, *supra* note 21, at 638-44.

or no decrease in the Success Rate. The former proposition is more likely, since most prisoners, many of whom are unrepresented by counsel after conviction, are unlikely to have the sophistication to recognize when a claim relies on a “new rule.” In any event, there would have to be a decrease in the Filing Rate, a decrease in the Success Rate, or a decrease in both to suggest that *Teague* decreased the availability of habeas relief.

B. HYPOTHESES REGARDING THE CONSEQUENCES OF AEDPA

AEDPA’s primary purpose is to streamline and expedite federal habeas corpus litigation.³⁰ Yackle proposes that, in the long run, this purpose may be realized, but in the near term, this is unlikely because federal courts face the challenge of interpreting AEDPA’s numerous features, which are notorious for their poor drafting.³¹ If Yackle’s proposition is correct, AEDPA would be followed by a temporary decrease in mechanical efficiency (an increase in the Disposal Time), followed by a long-term increase in mechanical efficiency (a decrease in the Disposal Time). However, as discussed in Section VI.B, the actual outcome is a temporary increase in the Disposal Time, with no long-term positive or negative impact on the Disposal Time.

AEDPA is also logically expected to result in a decreased Filing Rate. The provision requiring dismissal of a claim presented in a second or successive habeas corpus application that has also been presented in a prior application may increase allocative efficiency by discouraging successive duplicative applications and encouraging consolidation of claims into a single application, thus decreasing the Filing Rate. AEDPA may also increase mechanical efficiency by mandating courts to dismiss duplicative claims rather than relitigating them. This latter effect would manifest as a decrease in the Disposal Time for unsuccessful claims.

The AEDPA provision that requires federal courts to show deference to the determination of state courts, provided that these determinations are neither “contrary to” nor an “unreasonable application of” clearly established federal law as determined by the Supreme Court,³² is likely to affect both the Success Rate and Disposal Time. Because greater deference will be given to state determinations, petitioners are less likely to prevail. This provision is unlikely to lead to a decline in habeas filings because it is a confusing standard whose implications are not immediately apparent to prisoners. Thus, this provision will most likely be reflected by a decrease in the Disposal Time following AEDPA, because it will often relieve federal courts from conducting de novo fac-

³⁰ YACKLE, *supra* note 4, at 56.

³¹ *Id.* at 56–57.

³² 28 U.S.C. §2254(d).

tual determinations and force them instead to place greater reliance on state court judgments. On the other hand, courts may now find themselves burdened with lengthy litigation over whether a state court's legal determinations are "contrary to" or an "unreasonable" application of federal law, and whether its factual determinations are "reasonable." This effect would increase the Disposal Time after AEDPA's enactment. Of course, these effects are not mutually exclusive. It is quite possible that the greater deference to state judgments will reduce time spent litigating the substantive merits, while increasing the time spent litigating whether the state court's determinations are "contrary to" or "unreasonable." As a result, whether there is an increase or a decrease in the Disposal Time following AEDPA will depend on whether the efficiency gains from the decreased time allocated to de novo review and relitigation of duplicative successive claims outweigh the extra time required to litigate over the new issues created by AEDPA. Thus, the change in the Disposal Time will measure the "net effect" of AEDPA on mechanical efficiency in disposing of habeas petitions, especially meritless ones.

III. DATA

Data on habeas and prisoner civil rights cases from 1970 to 2003 was obtained from the Federal Court Cases Integrated Data Base³³ (including petitions filed by inmates sentenced to death) and organized by monthly increments to capture both short-term and long-term fluctuations in the Disposal Time, Filing Rate, and Success Rate. All cases still pending or terminated in federal district courts during statistical years 1983 through 2003 are included in the database.³⁴ Prison population statistics were obtained from the Bureau of Justice Statistics.³⁵

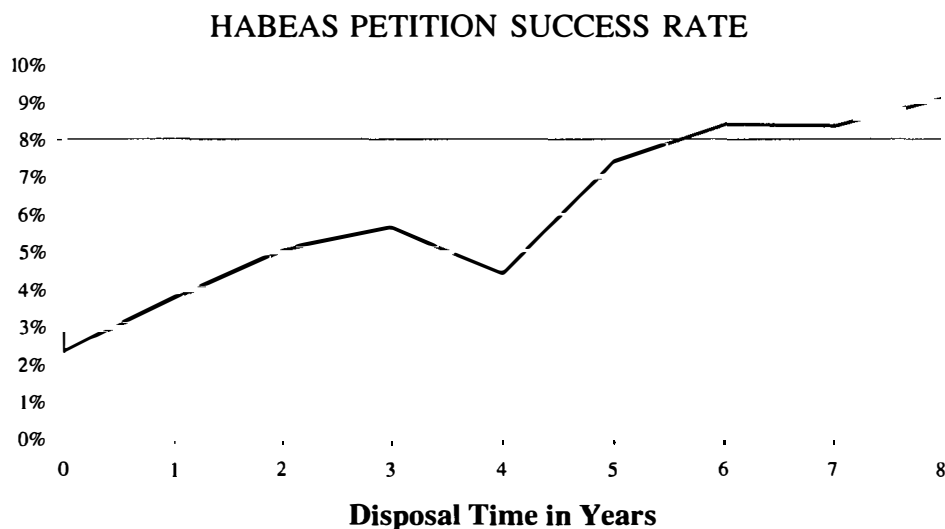
³³ FEDERAL JUDICIAL CENTER, FEDERAL COURT CASES: INTEGRATED DATA BASE, 1970–2000, 2001, 2002, 2003 (ICPSR 8429) [Computer file]. 3rd ICPSR version. Washington, DC: Federal Judicial Center [producer], 2003. Ann Arbor, MI: Interuniversity Consortium for Political and Social Research [distributor], 2004, *available at* <http://www.icpsr.umich.edu>.

³⁴ Up to 1992, the reporting period, or "statistical year," went from July through June (e.g., statistical year 1990 covered the period July 1989 through June 1990). In 1992, the statistical reporting period was changed to conform to the federal government's standard fiscal year, October through September (e.g., fiscal year 1993 covered the period October 1992 through September 1993). FEDERAL JUDICIAL CENTER, *supra* note 33, at FEDERAL COURT CASES: INTEGRATED DATA BASE, 1970–2000, Part 103: Civil Terminations, 1996 Codebook, at 7. To ensure the data was not distorted by this change, I excluded additional copies of duplicate observations.

³⁵ BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, PUB. NOS. NCJ 195189 (2002), NCJ 188207 (2001), NCJ 183476 (2000), NCJ 175687 (1999), NCJ 170014 (1998), NCJ 164619 (1997), NCJ 161132 (1996), NCJ 151654 (1995), PRISONERS IN (YEAREND) ANNUAL (1983–2001), *available at* <http://www.ojp.usdoj.gov/bjs/prisons.htm>; BUREAU OF JUSTICE STATISTICS, U.S. DEP'T OF JUSTICE, PUB. NOS. NCJ 192929 (1998), NCJ 177613 (1997), NCJ 170013 (1996), NCJ 163916 (1995), NCJ 160091 (1994), NCJ 156241 (1993), CORRECTIONAL POPULATIONS IN THE UNITED STATES, (annual release from 1993–1998), *available at* <http://www.ojp.usdoj.gov/bjs/prisons.htm>.

Several adjustments to the data were necessary to correct the following: (1) errors in recording the data, (2) duplicate observations, and (3) nonrandom sampling. To eliminate obvious errors, I excluded any observations reporting a termination date prior to the filing date and any observations that appeared to be duplicates.³⁶ The nature and resolution of the third problem is discussed below.

The data on habeas and prisoner civil rights claims were gathered from a database that has a separate datafile for each statistical year (“SY”) and category (civil terminations, civil pending, appellate terminations, appellate pending, etc.). For example, the 1970 civil terminations datafile contains information on every civil case terminated in a federal district court in the United States during the SY 1970 reporting period.³⁷ Years that fall late in the sample include filings that took a relatively short time to dispose of but not those with long enough Disposal Times to be terminated after SY 2003. For example, among all federal habeas claims filed in 2002, the only ones included in the sample are those terminated prior to the end of SY 2003. Thus, data files for later statistical years are likely to underestimate the average Disposal Time, as well as the Success Rate, since there is a correlation between the Disposal Time and Success Rate, as illustrated by the chart below.



The nonrandom sampling problem is mitigated by cutting off the tail ends of the sample, where the underestimation of the Disposal Time and Success Rate are most severe. Thus, only cases filed between June

³⁶ An observation was considered a “duplicate” if it was: filed in the same circuit, district, and office; had the same docket number; and was filed on the same date and terminated on the same date as another observation or observations in the sample.

³⁷ See FEDERAL JUDICIAL CENTER, *supra* note 33, at FEDERAL COURT CASES: INTEGRATED DATA BASE, 1970–2000, Part 103: Civil Terminations, 1996 Codebook, at 7.

1983 and September 2001 are used in the analysis,³⁸ although data is available for all cases terminated prior to September 2003, which includes cases filed after September 2001. Ninety percent of cases filed in September 2001 are terminated prior to September 2003 and are therefore included in the sample. Although this solution is far from perfect, underestimation of the Disposal Time in later periods does not undermine the validity of the inferences drawn from the estimation results. The danger presented by underestimation of the Disposal Time in later time periods is that the data may erroneously suggest that AEDPA, which took effect in April 1996, was followed by a long-term decrease in the Disposal Time. However, a contrary result is observed, as discussed below in Section VI; AEDPA temporarily *increased* the Disposal Time for meritless claims, and had no observable long-term effect on the Disposal Time.

IV. EMPIRICAL METHODOLOGY

This note employs interrupted time series analysis to evaluate the impact of *Teague* and AEDPA on the Success Rate, Filing Rate, and Disposal Time.³⁹ The methodology used is as follows. First, I generated monthly time series variables from the raw cross-sectional data in the Federal Court Cases Integrated Data Base (listed and described in Table 1). Second, I employed the iterative procedure described in McDowall et al.⁴⁰ for identifying ARIMA (autoregressive integrated moving average) intervention analysis models. Third, I selected among alternative models by analyzing the estimation results and measures of goodness of fit.

The iterative procedure for identifying an ARIMA model is described in detail in McDowall et al.; thus, this note will only briefly describe and identify departures in method from the McDowall approach. The first step of the McDowall iterative procedure is to examine the ACF (autocorrelation function) and PACF (partial autocorrelation function) for observations of the dependent variable in the pre-intervention period⁴¹ to determine whether the process is autoregressive [ARIMA(p,0,0)] or moving average [ARIMA(0,0,q)], what the likely or-

³⁸ Although there is accurate and complete data available as early as July 1979, it was not possible to include these early observations in the analysis because the measure of prisoner population used as the denominator in the Habeas Filing Rate variable was only available from 1977 until 1998, and since prisoner population is lagged 6 years in the denominator, the earliest year in which the Habeas Filing Rate could be generated is 1983.

³⁹ See DAVID MCDOWALL ET AL., *INTERRUPTED TIME SERIES ANALYSIS* (James Fennessey et al., eds., Sage Publications 1980).

⁴⁰ See *id.*

⁴¹ The event being analyzed, here *Teague* and AEDPA, is often referred to as an "intervention."

der of the process is, and whether the process is stationary (“Step 1”). The second step is to difference the series if it is not stationary and specify and estimate an ARIMA(p,d,q) pulse or step model based on the ACF and PACF (“Step 2”). The third step is to examine the ACF of the pre-intervention residuals obtained from the estimation for serial correlation (“Step 3”). If the Q-statistic for key lags (in this situation low-order lags—those under 12, and seasonal lags—12, 24, 36, etc.) is significant or there is a spike in the ACF, Step 2 must be repeated—specification and estimation of a new model—and then Step 3 must be repeated—examination of the ACFs of pre-intervention residuals. This process is repeated until obtaining a model whose pre-intervention residuals are free from spikes and significant Q-statistics for key lags. This iterative process was used for each of 16 models tested.

This study departs from the McDowall approach in several ways. First, interrupted time series analysis (also called intervention analysis, impact analysis, or event studies) is usually used to analyze the impact of a single event, whereas this study examines the impact of two separate events: (1) the announcement of the *Teague* retroactivity doctrine and (2) the enactment of AEDPA. To eliminate the difficulty in distinguishing between the effects of two interventions occurring over the same time span, this note analyzes the events separately and restricts the time period for each event. Thus, the analysis of *Teague*’s impact excludes all data points after the enactment of AEDPA. Similarly, analysis of AEDPA’s impact includes only post-*Teague* observations.

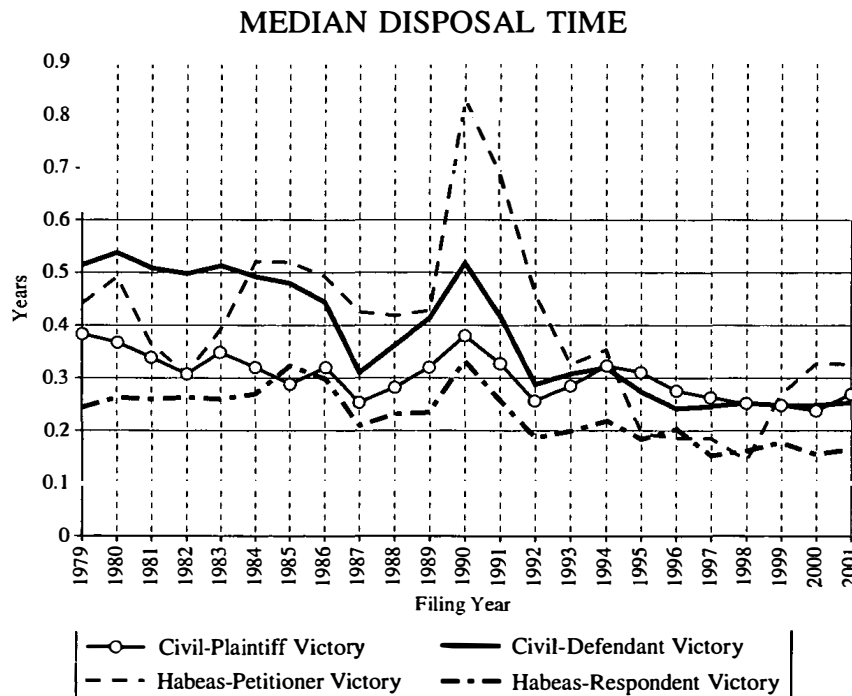
The second departure from the McDowall approach is a variation of the standard pulse model. This note estimates both a step model and a pulse model for each dependent variable and intervention. A step model divides the time period examined into two parts—pre-intervention and post-intervention—by including a binary dummy variable equal to 0 prior to the intervention and equal to 1 after the intervention. Thus, a step model tests for an abrupt *permanent* impact. In contrast, a pulse model includes as a dependent variable a binary dummy equal to 1 at the moment of the intervention and equal to 0 both before and after the intervention; this standard model tests for an abrupt *temporary* impact at the moment of intervention. The pulse models employed here define the “moment” of intervention differently. Whereas a standard pulse model dummy is equal to 1 only at the time of the intervention, the pulse dummy variables in this analysis are equal to 1 for the month of the intervention and for the 12 months following the intervention, and equal to 0 for all other months. For example, the pulse dummy variable used to analyze the effects of AEDPA (“AEDPA-Pulse”) equals 1 in months April 1996 to April 1997, and 0 for all other months. The reason for modification of the standard pulse model is that *Teague* or AEDPA may

have had a temporary impact that was realized several months after the event rather than instantly. In the lawmaking context, 13 months is a reasonable definition of the “moment” of intervention because it is a short enough duration to be distinguished from a permanent impact, yet long enough to capture slightly delayed reactions of litigants and federal district courts to a change in law.

A third departure from the McDowall methodology is that instead of seasonal differencing, I use seasonal dummy variables, one for each month. The seasonal dummies are included in all 16 equations, but their coefficients are not reported in the results tables.

V. ESTIMATION AND RESULTS

The Disposal Times for successful and failed habeas claims are analyzed separately for several reasons. First, the Disposal Time correlates with the probability of success; successful petitions take longer to dispose of than failed petitions, as illustrated by the chart below. Analyzing the processing time for successful and unsuccessful claims separately implicitly controls for this correlation.



Second, it is possible that an event will have different effects on the processing time for meritorious and meritless claims. For example, the AEDPA provision requiring dismissal of claims filed in a prior habeas application may decrease the Disposal Time for meritless, or unsuccessful, claims by making it easier to dismiss such filings. On the other

hand, this provision may discourage prisoners from filing extremely frivolous claims, which would cause the composition of failed habeas filings to become, on average, more meritorious (since the most frivolous claims drop out), which may manifest as an increase the average Disposal Time of the claims that are filed (since disposal time correlates with the probability of success). This AEDPA provision, however, should have absolutely no effect on the processing time of meritorious, or successful, claims. Thus, the only way to discern the precise effect of an event on mechanical efficiency is to analyze the Disposal Time separately for successful and failed petitions, henceforth referred to as the “Successful Disposal Time” and “Failed Disposal Time,” respectively.

Two necessary controls are included in the Disposal Time models. First, the average Disposal Time of all failed and successful federal civil claims is included in the Failed Disposal Time and Successful Disposal Time models, respectively. This is to control for changes in the Disposal Time that are common to *all* federal civil litigation that cannot be attributed to changes in habeas policy. Second, “Docket Crowdedness” is controlled for, which is a count of all civil claims in the federal court system during that month. A case is deemed to be “in” the system during month t if (a) it was filed during month t , or (b) it was filed in a prior month, $t - k$, but was not yet disposed of at the beginning of month t . This variable is controlled for because the Disposal Time will be higher when the docket is crowded and judicial resources are stretched. As shown in Table 2, this variable is positive and significant at the 1% level for all Failed Disposal Time models, confirming the logical inference that when dockets are crowded, it takes longer to dispose of meritless claims. Surprisingly, however, the coefficient on Docket Crowdedness is not significant in the Successful Disposal Time models, indicating that the Disposal Time for meritorious habeas petitions is unaffected by courts’ level of congestion.

The “Filing Rate” is defined as the number of habeas petitions filed per six-year lagged prisoner population. Thus, the Filing Rate is obtained by dividing the number of habeas petitions filed in month m by the prisoner population in month $m-72$. The relevant population is prisoners sentenced to more than one year because prisoners with shorter sentences are unlikely to exhaust state post-conviction remedies, and thus become eligible for federal habeas relief, before their sentences expire. The population denominator is lagged 72 months (six years) to account for the time it takes prisoners to exhaust state remedies. In other words, because there are often several years between conviction and filing of a habeas petition, an increase in the prison population in year t will probably not lead to an increase in the number of habeas petitions until n years later. A lag of six years was chosen after examining the coefficients of correla-

tion between various lags of prisoner population and the number of habeas filings. The six-year lag of prisoner population most strongly correlated with the habeas filing level, consistent with Cheesman et al.'s similar determination of regular prisoner population (includes prisoners with sentences less than one year in length).⁴²

I estimated a series of equations analogous to the Filing Rate models reported in equations 13 through 16 of Table 3 (the "Filing Rate Models"). This series of equations, whose estimation results are not reported here, includes the Success Rate and prisoner civil rights filing rate (the "PCR Filing Rate") as controls. These estimates are not reported, but the rationale for including these controls and subsequently dropping them is as follows. The Success Rate (defined as the number of habeas petitions coded as "judgment for plaintiff" in the Federal Court Cases Integrated Data Base divided by the total number of habeas filings in that time period) may influence the Filing Rate because an increase in the probability of obtaining habeas relief may cause prisoners to respond with an increase in filings. However, in all four alternative Filing Rate Models (TEAGUE-Step, TEAGUE-Pulse, AEDPA-Step, and AEDPA-Pulse), the Success Rate was statistically insignificant. These models include the PCR Filing Rate because an increase in prisoner civil rights filings following AEDPA coupled with a decline in habeas filings would suggest that AEDPA, rather than eliminating the overall burden to courts from frivolous prisoner claims, may have merely shifted prisoner litigation from habeas petitions to prisoner civil rights complaints. This variable, in all relevant models (AEDPA-Step and AEDPA-Pulse), had a positive and statistically significant coefficient, refuting the aforementioned hypothesis. Thus, it would be erroneous to conclude that the prisoner civil rights filing rate "causes" changes in the habeas petition rate in any sense; the positive correlation between these filing rates suggests that, rather than being substitute forms of post-conviction relief (which would be indicated by a negative correlation), the two types of filing rates are influenced by common factors affecting prisoner litigation in general, such as the availability of free counsel in pursuing post-conviction remedies. Because the aforementioned analysis suggests that neither the Success Rate nor the PCR Filing Rate is a necessary control variable in the Filing Rate Models, these variables were excluded from the equations reported and discussed in this note.

In models analyzing Teague and AEDPA's impact on the Success Rate (models in which Success Rate is the dependent variable), the Filing Rate is controlled for because a decrease in the Filing Rate may indicate a decline in frivolous filings, which would result in a higher percentage

⁴² See CHEESMAN, OSTROM & HANSON, *supra* note 25, at 64.

of meritorious or successful petitions. Therefore, controlling for the Filing Rate makes it possible to distinguish between a shift in the Success rate caused by a change in the difficulty of obtaining relief and a shift caused by a change in the composition of claims filed. In all four models, shown in Table 3, equations 9 through 12 (the "Success Rate Models"), this variable has a negative coefficient, consistent with the aforementioned hypothesis, but is not significant.

The possibility that the Filing Rate is endogenous in the Success Rate Models—that a higher probability of success encourages more filings—has been ruled out. Hausman tests for endogeneity of the Filing Rate were performed for all four Success Rate models; the null hypothesis of exogeneity could not be rejected at even a marginally significant level. Furthermore, as discussed above, in models estimated with the Filing Rate as the dependent variable and the Success Rate as an explanatory variable, the coefficient on Success Rate was not even marginally significant, further ruling out the possibility of endogeneity. Another set of equations analogous to the Success Rate Models with 12- and 24-month lags (not reported) were estimated to account for the time it may take prisoners to perceive and respond to a change in the probability of successfully obtaining habeas relief. These estimations returned similar results. Thus, the Filing Rate can safely be treated as an exogenous control variable.

VI. DISCUSSION

A. EMPIRICAL IMPACT OF *TEAGUE*

Teague had neither a temporary nor a permanent impact on the Success Rate or the Filing Rate, suggesting no effect whatsoever on allocative efficiency. However, *Teague* did undermine mechanical efficiency by increasing the Disposal Time of failed claims permanently and increasing the Disposal Time for successful petitions temporarily. As illustrated in Table 2, equations 1, 2, 5, and 6, the intervention variable is positive and highly significant in the step model for Failed Disposal Time and the pulse model for Successful Disposal Time. There are several explanations for this pattern. The temporary impact on meritorious (successful) habeas petitions is most likely due to temporary confusion in applying the *Teague* doctrine. The permanent increase in the Disposal Time for meritless (failed) habeas petitions requires a more careful examination.

One explanation for this permanent increase in Disposal Time is that *Teague* generated a new set of procedural requirements and issues needing to be litigated whose burden outweighed any reduction in time formerly spent on litigating the merits. Now courts must determine

whether a claim is based on a “new rule,” and if it is, courts must determine whether the limited exceptions of *Teague* apply.

An alternative explanation is that *Teague*, by making it more difficult to obtain habeas relief, discouraged filings that were the most frivolous. If the extremely frivolous filings drop out of the failed population, the remaining cases would possess relatively greater merit and therefore take longer to resolve (recall that Disposal Time is correlated with the probability of success). However, in such a situation there should be at least a marginal decline in the Filing Rate and possibly the Success Rate, and there is no such decline, as illustrated by equations 9, 10, 13, and 14 of Table 2. Thus, the only robust conclusion is that *Teague* impaired courts’ efficiency in disposing of meritless claims.

Surprisingly, *Teague* was not followed by a decline in either the Success Rate or the Filing Rate (equations 9, 10, 13, and 14). Thus, critics’ characterization of *Teague* as severely restricting the availability of habeas relief appears exaggerated, if not completely inaccurate. As suggested in Section I.B, even an expansive interpretation of “new rule” should be expected only to delay the full impact of both favorable and unfavorable new rules, not to permanently decrease the availability of habeas relief.

In summary, the estimation results are as follows: First, *Teague* permanently increased the Failed Disposal Time and temporarily increased the Successful Disposal Time. Second, *Teague* has demonstrated no impact on the Success Rate, suggesting that it has not made habeas relief more difficult to obtain as critics have suggested. Third, *Teague* has made no impact on the Filing Rate. Thus, *Teague*’s only long-term empirical impact is impairment of mechanical efficiency in disposing of meritless claims.

B. EMPIRICAL IMPACT OF AEDPA

As shown in Table 2, equation 4, the AEDPA-Pulse variable is a positive and highly significant determinant of Failed Disposal Time, whereas the coefficient on the AEDPA-Step variable is not (equation 3). Furthermore, the Akaike Information Criterion (the “AIC”) and Schwartz Information Criterion (the “SIC”) are more negative in the pulse model than in the step model of Failed Disposal Time.⁴³ Thus, the pulse model is a better fit, implying that AEDPA temporarily increased the Disposal Time for meritless claims, without permanently affecting the Failed Disposal Time. The temporary increase in the Disposal Time of meritless claims is probably due to confusion and delay resulting from lower

⁴³ The AIC and SIC are measures of goodness-of-fit. A smaller, or more negative, value of either AIC or SIC indicates a better model.

courts' initial clumsiness in applying AEDPA's provisions. Thus, since no long-term impact on Failed Disposal Time resulted (the coefficient in the step model is insignificant), AEDPA did not improve mechanical efficiency in the disposal of meritless claims.

An alternative explanation is that AEDPA increased allocative efficiency by discouraging the most frivolous of the meritless filings, leading to an increase in the average processing time, not due to any decrease in efficiency, but due rather to a change in the composition of meritless filings. However, the absence of a long-term decrease in the filing rate contradicts this explanation.

Despite the apparent weakness of the AEDPA-Step Disposal Time model, it is possible that AEDPA's long-term impact on Disposal Time has been to worsen mechanical efficiency, but that this impact is not reflected by the estimation results because the Disposal Time is underestimated in later years due to the nonrandom sampling problem discussed in Section III.

Consistent with Cheesman et al.'s findings,⁴⁴ equations 15 and 16 in Table 2 indicate that AEDPA temporarily increased the Filing Rate and did not achieve its objective of permanently decreasing the Filing Rate. In the AEDPA-Pulse Filing Rate Model, the intervention term is positive and highly significant, indicating a temporary positive impact on filing rates. The step model is a poorer model, indicated by its higher AIC and SIC and insignificant intervention term. Furthermore, the coefficient on the intervention term in the AEDPA-Step Model is not statistically significant. Thus, AEDPA produced no long-term impact on the Filing Rates.

AEDPA did, however, make a significant long-term impact on the Success Rate. The intervention variable in equation 11, the AEDPA-Step Model of Success Rate, has a negative and highly significant coefficient, indicating that AEDPA permanently decreased the probability of obtaining habeas relief.

In summary, these findings compel several conclusions. The first is that AEDPA failed to streamline the writ of habeas corpus. AEDPA produced no long-term decrease in the filing rate, so its statute of limitations and mandate of dismissal for successive applications presenting the same claims failed to lighten the burden of habeas petitions on the court system. Second, these provisions, combined with AEDPA's provision for increased deference to state determinations, did not enhance mechanical efficiency in processing habeas petitions, since the Disposal Times for both meritorious and meritless claims did not decline in the years follow-

⁴⁴ See CHEESMAN, OSTROM & HANSON, *supra* note 25, at 64.

ing AEDPA, and may in fact have risen. Third, AEDPA permanently decreased the probability of success in obtaining habeas relief.

C. BROADER JURISPRUDENTIAL IMPLICATIONS

If legislation and Supreme Court decisions served their purported function of resolving circuit court splits and otherwise resolving legal ambiguities, major decisions and legislation would cause a decrease in the Disposal Time, since lower courts would benefit from a new rule or standard that quickly resolved issues that previously had to be litigated. The permanent increase in the Disposal Time that followed *Teague* and the temporary increase that followed AEDPA suggest the opposite; when Congress or the Supreme Court attempt to declare or clarify what the law is, they may instead render the law even more ambiguous.

The consequences flowing logically from the *Teague* holding are illustrative. In *Teague*, the Supreme Court overruled *Linkletter*,⁴⁵ which had been settled law for over two decades, and criticized its standard for leading to “inconsistent results” and the “disparate treatment of similarly situated defendants.”⁴⁶ In an attempt to correct these deficiencies, the Court fashioned a new standard that resulted in a host of new issues lower courts must address. First, courts are faced with the challenge of determining whether a claim depends on a “new rule.” If so, the court must determine if one of the exceptions applies; if not, the court must determine what the law was at the time that a prisoner’s conviction became final. Additionally, if the court is attempting to apply settled law to novel facts or make a serious legal judgment, it must determine whether this amounts to the creation of a new rule. Thus, in an attempt to correct deficiencies in the former regime, the Supreme Court produced a complex set of standards that appears even more problematic in light of the permanent increase in Disposal Time for meritless claims following the *Teague* decision. This decline in efficiency suggests *Teague* produced a disorienting rather than settling effect on the application of habeas doctrine.

Similarly, AEDPA generated more legal questions than legal answers for courts, as suggested by the short-term increase in the Disposal Time for failed petitions following AEDPA’s enactment. AEDPA’s “contrary to” and “unreasonable” standards⁴⁷ are particularly troublesome. The Supreme Court’s attempt in *Williams* to apply AEDPA’s “unreasonable” standard produced a fragmented opinion in which six justices joined in Parts I, II, and IV of the opinion of the Court, three justices joined in Part II, two justices joined in Part II except as to a

⁴⁵ See generally *Linkletter*, 381 U.S. 618.

⁴⁶ *Teague*, 489 U.S. at 302-303.

⁴⁷ See generally *Williams*, 529 U.S. 362.

footnote, two justices joined in a separate opinion, concurring in part and concurring in the judgment, and two justices joined in a separate opinion concurring in part and dissenting in part.⁴⁸ In light of the Supreme Court's fragmentation over AEDPA, it is no surprise that shortly following AEDPA's enactment, lower courts were confused about how to interpret its provisions.

The implications of this study are not limited to the habeas corpus context. This study undermines the assumption regarding judicial lawmaking and legislation that the Supreme Court and Congress primarily resolve questions of unsettled law and provide clearer and more uniform legal standards. The impact of *Teague* and AEDPA suggests the contrary: the Supreme Court and Congress may create more numerous and problematic legal issues and standards than they successfully resolve.

CONCLUSION

Teague v. Lane permanently increased the amount of time required to dispose of meritless habeas petitions and temporarily increased the time required to dispose of meritorious claims. Thus, *Teague*'s net effect was to increase the burden of habeas litigation on federal courts, since it now takes longer to dispose of meritless claims. Also, contrary to virtually all characterizations of *Teague* as severely restricting the availability of habeas corpus, *Teague* did not decrease the probability of a petitioner's success.

Although AEDPA permanently decreased the probability of obtaining a successful habeas petition, it failed to achieve its main objectives: to reduce frivolous filings and to streamline the disposal of habeas petitions. AEDPA failed to produce long-term declines in the Filing Rate or Disposal Rate, despite Congress's intent that the AEDPA provisions requiring dismissal of duplicate successive claims would, at the very least, expedite the disposal of meritless claims. Thus, despite observers' regard of AEDPA as a "complete overhaul" of federal habeas doctrine, AEDPA appears to have achieved nothing in terms of judicial efficiency. However, since AEDPA is still a fairly recent enactment in the context of a continually evolving federal habeas jurisprudence, it is possible that the limited sample period examined here, which ends in September 2001, has simply not captured the long-term effects of AEDPA.

The empirical impact of the *Teague* decision and AEDPA are poorly aligned with the expectations of the legal community and the intent of their creators. Therefore, this note's findings suggest that the practical implications of the lawmaking process, whether judicial or leg-

⁴⁸ See *id.*

islative, are difficult to predict and are in fact badly mistaken by both observers and those who create the law. Therefore, additional empirical analysis of the practical implications of statutory and common law may be useful to develop and test theories that shed light on which circumstances, if any, result in effective lawmaking—lawmaking that achieves its intended objective—and which circumstances result in ineffective lawmaking.

TABLE 1: VARIABLE DESCRIPTIONS

VARIABLE LABEL	TYPE	DEFINITION
SUCCESS_RATE	Continuous	Habeas Success Rate, defined as the number of petitions coded as "judgment for plaintiff" in the U.S. Courts database filed in month t divided by the total number of habeas filings in month t
DISPOSAL TIME	Continuous	Average number of years between filing and termination for all cases filed in month t
Successful Habeas Filings	Continuous	Average Disposal Time of habeas petitions coded as "judgment for plaintiff" filed in month t
Failed Habeas Filings	Continuous	Average Disposal Time of habeas petitions coded as "judgment for defendant" filed in month t
Successful Civil Filings	Continuous	Average Disposal Time of all federal civil cases coded as "judgment for plaintiff" filed in month t
Failed Civil Filings	Continuous	Average Disposal Time of all federal civil cases coded as "judgment for defendant" filed in month t
FILING_RATE_HABEAS	Continuous	Habeas petitions filed per prisoner capita, obtained by dividing the number of habeas petitions filed in month t by the number of prisoners with a sentence of over one year in month $t-72$ (6 year lag)
FILING_RATE_PCR	Continuous	Prisoner civil rights (PCR) filings per one thousand prisoner capita, obtained by dividing the number of PCR claims filed during the quarter by the total prisoner population on Dec. 31st of the calendar year
DOCKET_CROWDEDNESS	Continuous	Number of cases on the docket at anytime during month t
TEAGUE_STEP	Binary Dummy	Dummy equal to 1 after February 1989, the month the <i>Teague</i> decision was issued, and equal to 0 at all times prior to <i>Teague</i>
TEAGUE_PULSE	Binary Dummy	Dummy equal to 1 from February 1989 until February 1990, equal to 0 in all other periods
AEDPA_STEP	Binary Dummy	Dummy equal to 1 after April 1996, the month AEDPA was enacted and became effective, equal to 0 prior to AEDPA's enactment
AEDPA_PULSE	Binary Dummy	Dummy equal to 1 from April 1996 until April 1997, equal to 0 in all other periods

TABLE 2: REGRESSION RESULTS

	DEPENDENT VARIABLE							
	1	2	3	4	5	6	7	8
	FAILED DISPOSAL TIME							
	SUCCESSFUL DISPOSAL TIME							
TEAGUE STEP	0.1375*** [0.007]				0.0693 [0.507]			
TEAGUE PULSE		0.0621 [0.557]				0.2671*** [0.009]		
AEDPA_STEP			0.0126526 [0.925]				-0.0280 [0.889]	
AEDPA_PULSE				0.0823** [0.023]				0.0574 [0.779]
DISPOSAL TIME-Failed Civil	0.6393*** [0]	0.5261*** [0.003]	0.8149*** [0]	0.8154*** [0]				
DISPOSAL TIME-Successful Civil					-0.172312 [0.544]	-0.0102 [0.97]	0.4096 [0.398]	0.3877 [0.429]
DOCKET CROWDEDNESS	1.19E-06 [0.126]	-1.83E-09 [0.998]	1.53E-06 [0.118]	1.84E-06* [0.085]	-2.12E-06 [0.138]	-2.11E-06* [0.083]	3.01E-07 [0.902]	-1.81E-08 [0.993]
CONSTANT	-0.2398 [0.503]	0.2260 [0.506]	0.0001 [0.976]	0.0001 [0.971]	1.8962 [0.5578]	1.7741*** [0]	0.9833 [0.259]	1.0575 [0.221]
Observations	214	214	152	152	214	214	152	152
Sample Time Span	07/1983 - 04/1996	07/1983 - 04/1996	04/1996 - 09/2001	04/1996 - 09/2001	07/1983 - 04/1996	07/1983 - 04/1996	04/1996 - 09/2001	04/1996 - 09/2001
AIC	-407.903	-399.365	-416.662	-421.718	165.683	158.713	172.287	172.205
SIC	-353.238	-344.700	-365.256	-370.312	211.237	210.341	235.788	235.707
ARIMA(p,d,q)	(3,0,0)	(3,0,0)	(2,1,0)	(2,1,0)	(0,0,0)	(2,0,0)	(6,0,0)	(6,0,0)

* Significant at 10%; ** significant at 5%; *** significant at 1%

P-values reported in brackets []

Autoregressive terms and seasonal dummy variables omitted

TABLE 3: REGRESSION RESULTS

Equation #	HABEAS SUCCESS RATE					DEPENDENT VARIABLE				
	9	10	11	12	13	14	15	16		
TEAGUE STEP	-0.0008 [0.875]				-0.0003 [0.701]					
TEAGUE PULSE		-0.0010 [0.754]				-0.0002 [0.7]				
AEDPA STEP			-0.0044*** [0.005]				-0.0001 [0.89]			
AEDPA PULSE				0.0003 [0.928]				0.0006*** [0.004]		
FILING RATE	-1.5102 [0.452]	-1.5500 [0.446]	-0.6053 0.563	-0.6675 0.613						
CONSTANT	-0.0000 [0.726]	-0.0001 [0.699]	0.0160*** [0]	0.0144*** [0]	-0.0000 [0.852]	-0.0000 [0.802]	-0.0000 [0.91]	-0.0000 [0.897]		
Observations	214	214	152	152	214	214	152	152		
Sample Time Span	07/1983 - 04/1996	07/1983 - 04/1996	04/1996 - 09/2001	04/1996 - 09/2001	07/1983 - 04/1996	07/1983 - 04/1996	04/1996 - 09/2001	04/1996 - 09/2001		
AIC	-1057.5675	-1057.7166	-1217.1772	-1208.2279	-1858.4097	-1858.9911	-1962.322	-1968.8584		
SIC	-998.59232	-998.74142	-1165.7712	-1156.8219	-1811.2295	-1811.8109	-1907.8921	-1914.4286		
ARIMA(p,d,q)	(6,1,0)	(6,1,0)	(3,0,0)	(3,0,0)	(3,1,0)	(3,1,0)	(5,1,0)	(5,1,0)		

* Significant at 10%; ** significant at 5%; *** significant at 1%

P-values reported in brackets []

Autoregressive terms and seasonal dummy variables omitted