Evaluating Justice: An Empirical Analysis of Mexico's New Criminal Justice System

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Abstract: I evaluate the effects of switching from a mixed-inquisitorial to an adversarial system of justice on judicial efficiency. Using fixed-effects models, significant differences in total case backlog are found between states that adopted the adversarial system before 2015 and those that did not. These findings are robust after controls and two-way fixed effects. Through a difference-in-differences app roach, a causal relationship was established—states that switched to the adversarial system prior to 2015 experienced an increase in their case backlog while appeal rates remained unchanged. Given policy lags, limited data availability, and staggered adoption of treatment, theory suggests the results of this study would greatly benefit from additional years of data.

Keywords: *Inquisitorial, adversarial, legal origins, crime and punishment, difference in differences, judicial efficiency, econometrics.*

I. Introduction

> "An efficient dispute-resolution scheme should seek to minimize error costs, *ceteris paribus*"
>
> *(Zywicki, 2008)*

Throughout history, legal institutions have emerged to enforce society's norms. From trial by combat, divine punishment, and Athenian law to modern systems of justice, the enforcement of rules carries nominal and real costs. At the core of these structures, lies a dilemma—a balance to be stricken between punishing all offenders and safeguarding the rights of the innocent.

In 1968, Gary S. Becker became the first economist to evaluate this dilemma using the economic approach. Using an optimization approach, *Crime and Punishment* considers the costs and incentives present in deterring and punishing crime. Where perfect *deterrence* is the goal, perfect results are achieved by increasing the probability of conviction (p) to 1. Yet this approach, Becker reasons, ignores the marginally increasing social cost of preventing crime. In terms of *punishment*, conventional thinking of making "the punishment fit the crime" ignores the social cost of increased punishment, i.e., tax-payer burden for maintaining prisons and the resources spent attempting to prevent that crime from taking place. As such, Becker proposes the optimal punishment (f) for a given offense $(\hat{O})$ must not only take into account the harm to the victim (H) but also the social cost of *deterring* and *punishing* that crime (C), formally;

$$f = H\left(\hat{O}\right) + C\left(\hat{O}, p\right)$$

Optimality conditions find the optimal punishment to be exactly equal to the damages incurred by the victim plus the social cost of deterring and punishing said crime (Becker, 1974).

$$H'\left(\hat{O}\right) + C'\left(\hat{O}, p\right) - f' = 0$$

Becker's understanding of the probability of conviction inherently includes administrative (a) and error costs (e). Administrative costs are understood as the costs of dispute resolution, i.e., professional salaries, while error costs refer to the cost of inaccuracy, i.e., convicting the innocent, or setting the guilty free. A marginal increase in the probability of conviction will likely raise administrative costs—a direct relationship is suspected. This is supported by Posner (1969), who believes administrative and error costs to be part of the total social cost of punishment. Revising the cost term, we exclude p as this captured in p and e;

$$C = C\left(\hat{O}, a, e\right)$$

While an increase in administrative costs may raise the probability of convictions, this says nothing about the quality of said conviction. Was an innocent person convicted? Alternatively, was a guilty person set free? Optimality conditions of Becker's theoretical framework would allow increases in administrative costs insofar as they are justified by rightful convictions. Administrative costs below optimality will have a propensity to benefit the guilty while administrative costs above optimality will benefit the innocent. Yet punishing all crime is an unfeasible endeavor. As such, tribunes must deliver justice weighing administrative costs and the rights of the accused. Uncertainty remains as to which of the most common legal frameworks, French civil law or British common law, is better equipped for this task. The nature of court proceedings under each of these systems is essential to understanding the administrative and errors costs associated with each, as such, the following discussion seeks to explain these differences.

A. Legal Origins

The success of a justice system depends on the government's ability to shield rule enforcers from the evils of coercion and corruption (Glaeser & Schleifer, 2002). "People demand a dictatorship when they fear a dictator less than they fear each other" (Olson, 1993). The evolution of common and civil law stem from the British and French government's ability to protect their rule enforcers (Glaeser & Schleifer, 2002; Zywicki, 2008; D'Amico & Williamson, 2015). Given country specific experiences with colonialist rule, legal origins define how justice is delivered in the modern world across jurisdictions (D'Amico & Williamson, 2015).

French civil law developed as the impartial delivery of justice was compromised when the interests of powerful local lords were at play. The presence of these strong, local lords meant that trials by jury were unlikely to be successful as jurors would be highly vulnerable to coercion. Given these constraints, the French chose to rely on state-employed judges (Glaeser & Schleifer, 2002). Central to French civil law is the inquisitorial nature of its trials. Under the inquisitorial scheme, judges are tasked with questioning witnesses, preparing written records, and are the sole determinant of the outcome of the case. Attorneys under the inquisitorial system may submit questions for witnesses in writing to the presiding judge, but are otherwise not allowed to examine or cross-examine witnesses.

The English, in contrast, had weaker local magnates, making its jurors were less vulnerable to coercion (Glaeser & Schleifer, 2002). Thus, common law, a system of justice believed to have spontaneously evolved out of the customary practices of English men and women midway through the fifth century (Zywicki, 2008), relied on adversarial criminal trials. The adversarial system allows prosecutors and defendants the opportunity to plead their cases before impartial, non-vulnerable jurors with judges serving in a supervisory capacity.

The proceedings adopted under each of these systems is crucial to understanding the associated administrative and error costs. To that extent, Becker's *Crime and Punishment* (1968) expanded the bounds of economic theory into the courtroom by giving rise to a long-standing academic debate questioning the capacity of the two most common legal framework to deliver justice. Led by respected economists, Gordon Tullock and Richard Posner, the debate remains unsettled.

B. The Tullock-Posner Debate

Tullock, focusing on the efficiency of legal processes and its relative costs, favors civil law. The relentless common law critic believed adversarial courtrooms to be truth-obscuring, increasing both administrative and error costs. Tullock's framing of adversarial trials as truth-obscuring comes from his critique of rules of evidence, namely the inadmissibility of hearsay testimony and exclusion of illegally obtained evidence. Citing comparatively high error rates in jury trials (Shughart, 2018), Tullock found adversarial systems to be plagued by rent-seeking making it, rendering them ineffective and more expensive when compared to the judge-led system (Parisi, 2002; Zwycki, 2007). On the other hand, Posner, a retired appeals judge and fierce defender of the common law, asserts the incentives present in inquisitorial proceedings increase the cost of justice while the structure of the adversarial system leads to efficient truth-finding mechanisms superior to the inquisitorial system of justice (Posner, 1999).

The Tullock-Posner debate lacks defensible evidence. The present study expands the law and economics literature through the empirical analysis of judicial efficiency following Mexico's switch from an inquisitorial to an adversarial system of justice and gets us closer to understanding the economic efficiencies under each framework of judicial procedure.

C. Mexico as a Laboratory

In 2008, faced with corruption, impunity, and procedural rights violations, Mexico disbanded its mixed-inquisitorial system of justice. As a civil law country, Mexico's justice system was established at the time of the nation's founding and was codified by the Mexican Constitution of 1917. Through a Constitutional amendment, Art. 20 now reads:

> "Criminal proceedings will be adversarial and oral. They will be guided by the principles of openness, adversity, concentration, continuity and immediacy."
>
> *(Political Constitution of the United Mexican States, Article 20)*

The Congressional initiative required states to adopt the new system by 2016 establishing new guidelines for prosecuting criminal cases safeguarding due process and protecting the accused. Jury trials were not a requirement under the new framework, instead judge panels were employed. Meeting the congressional deadline quickly became a challenge for many states as the new justice system required drastic changes, such as investing in courtroom infrastructure and training courtroom staff and attorneys. Substantial efforts were undertaken at the time of President Enrique Pena Nieto in 2012 to ensure states were on track to meet the deadline. It worked—all but two states switched to the new system by 2015 (Shirk & Rodriguez Ferreira, 2015).[1]

The criminal justice reform undergone by Mexico in 2008 enables us to evaluate judicial efficiency in terms of the error costs under the two most common systems of justice—a long overdue analysis. Previous work studied the effects of the reform on perceived citizen security (Pasara, 2009) as well as the impact on victimization (Blanco, 2012), however, this reform has yet to be empirically assessed from a law and economics standpoint. Understanding the impact of the new judicial framework can have far reaching implications as it helps illuminate policymakers' initiatives directed at bolstering Mexico's rule of law. Methods for analysis are outlined in the following section with Section 2.1 establishing a theoretical framework from Tullock-Posner perspectives, methods for empirical analysis are outlined in the remainder of Section 2, Section 3 presents results, Section 4 discusses their implications; Section 5 concludes.

II. Methods

The present analysis estimates the effect of switching from an inquisitorial to an adversarial system of justice. In the context of judicial reform, policy interventions can be evaluated through the resulting efficiency and transparency of the reformed system (Blanco, 2012). To that extent, previous literature has used instruments to quantify and understand efficiency and transparency—i.e., in analyzing the effect of judicial reform in Latin American countries, Pasara (2009) uses the *length of judicial proceedings* and the

[1]Although the policy had been implemented, many of these states did not have operational adversarial trials across all its municipalities until 2016 (Shirk & Ferreira, 2015)

quality of resulting convictions to evaluate the Chilean justice system. Adapting Pasara's approach to the purpose of this study, administrative costs are understood as a function of the length of judicial proceedings and error costs a function of the resulting quality of convictions. By definition, error costs and quality of convictions are homologous metrics. In terms of administrative costs, under the assumption that longer proceedings lead to a higher case backlog which incur higher administrative costs, the length of judicial proceedings through case backlog is a useful way to measure this variable.

Under this framing, judicial efficiency can be understood as a function that maximizes the quality of convictions (Q) and reduces the length of judicial proceedings (L), with the state as the maximizing agent choosing the justice system, adversarial or inquisitorial, to file cases under.

The quality of convictions can be measured using the rate of appeals (ar), defined as the number of appeals filed divided by the number of cases solved in district courts in a given year. The rate of appeals is a function of the share of cases filed under each system; adversarial (f_A) or inquisitorial (f_I or $f_A - 1$) and the rate of prosecution (pr), defined as the number of complaints divided by the number of total cases prosecuted under any system in a given year (See Model A). This approach is consistent with that employed by the Council of European Commission for the Efficiency of Justice (CEPEJ). Appeal rates are used to understand the quality of convictions under the intuition that wrongful verdicts have a propensity to be relitigated—allowing us to measure both quality of convictions and evidence production under each system as defendants will file appeals where the lower court erred or did not exhaust the available evidence.

$$Q(f_A, f_I, pr) \qquad \text{(A)}$$

The length of proceedings, measured through case backlog, is a function of the share of cases filed under each system; the rate of prosecution (pr), number of complaints filed divided by the number of new cases in first instance; and the case clearance rate (cr), defined as the total number of new cases (both first and second instance) divided by the cases solved in any given year (both first and second instance)[2] (See Model B).

$$L(f_A, f_I,\ pr, cr)) \qquad \text{(B)}$$

modeling the benefit and cost functions;

$$Efficiency = Q(f_A, f_I, pr) - L(f_A, f_I,\ pr, cr) \qquad \text{(C)}$$

in terms of maximization;

$$\max_{f_A, f_I} Q(f_A, f_I, pr) - L(f_A, f_I,\ pr, cr) \qquad \text{(D)}$$

[2] First instance refers to lower district courts with original jurisdiction over criminal matters; second instance refers to courts with appellate jurisdiction only.

From a Posner perspective, the partial derivative of (Q) with respect to the ratio of cases filed under the adversarial system is positive (See E).

$$\frac{\partial Q}{\partial f_A} > 0 \qquad \text{(E)}$$

Tullock would disagree, from his perspective the partial derivative of (Q) with respect to the ratio of cases filed under the *adversarial system* is negative (See F). Conversely, the partial derivative of (Q) with respect to the ratio of cases filed under the *inquisitorial system* is positive (See G).

$$\frac{\partial Q}{\partial f_A} <<< 0 \qquad \text{(F)}$$

$$\frac{\partial Q}{\partial f_I} <<< 0 \qquad \text{(G)}$$

Given the staggered adoption of the adversarial system, Mexican states represent a perfect mechanism to test the theory of this model. With some states having all their cases processed through either system, f_A and f_I take the form of *0* or *1* depending on when treatment is set. Allowing us to study how the case backlog (length of proceedings) and appeal rates (quality of resulting convictions) vary within the model when treatment is adopted.

A. Mexico as a Laboratory

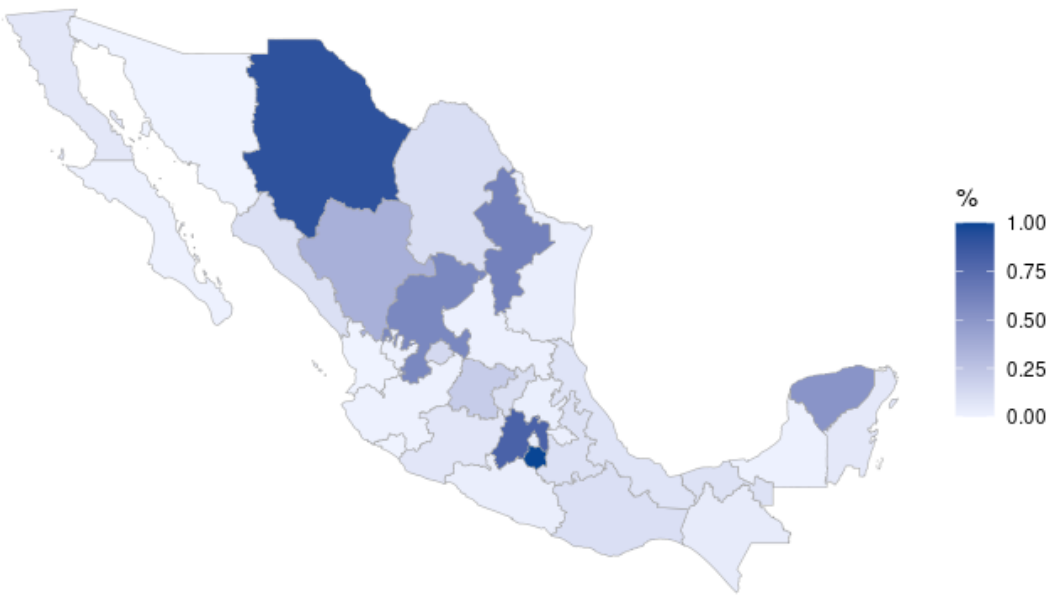
This study considers state level data. Data was accessed from the INEGI API database and collapsed by the author. It consists of various surveys conducted by the Mexican National Institute of Statistics and Geography (INEGI) including; National Survey on Employment and Occupation (Encuesta Nacional de Ocupación y Empleo, ENOE); National Survey on Public Safety Perception end Victimization (Encuesta Nacional de Victimización y Percepción sobre Seguridad Pública, ENVIPE); National Survey on Urban Public Safety (Encuesta Nacional de Seguridad Pública Urbana, ENSU); National Census on State Impartment of Justice (Censo Nacional de Impartición de Justicia Estatal, CNIJE); 2010 Population Census (Censo y Conteos de Población y Vivienda 2010.) Data regarding the year during which states switched to the new system was obtained from Shirk & Rodriguez Ferreira (2015). The data panel ranges from 2010 to 2018 and contains observations for all Mexican entities.

B. Assignment of Treatment Groups

As states switched to the adversarial system at varying times, the relative share of treated versus untreated states at any given year was an important factor weighing in the decision to set a treatment baseline (See Appendix. 2 for specifics). In fact, it was not until 2014 that over 50% of states had made that switch. Furthermore, the Shirk & Ferreira (2015) report indicates that it wasn't until 2015 that half of all municipalities in Mexico

were in judicial districts fully operating under the new model of criminal procedure.[3] As 2015 represents the year almost exactly half the population had access to the new system, it was chosen as the cutoff point for treatment. Consistently, states that switched to the new system before 2015 were considered treated, all other states were classified as untreated.[4] Among these states, however, the degree to which adversarial trials were being conducted varied greatly—from 1.05% to 100% (See below).

Fig. 1 Adversarial Trials as a Percent of Total Trials in 2015



C. Data Analysis

Wrangling was done in R Studio using the *dplyr and tidyverse* packages; data analysis was done with the *plm* and *car* packages following developer instructions (R Studio) and Reyna (2010); table outputs were generated using the *stargazer* package; maps were created using the *mxmaps* package. Preliminary data analysis evaluated variable relationships by creating a correlation matrix for all numeric variables in the dataset (See Appendix. 2). Strong correlations are present between the variables of interest (case backlog, clearance rate, prosecution rate, and rate of appeals) and state income levels and metrics of crime. Having set the treatment baseline, I regressed models with the efficiency parameters discussed in the theoretical framing as the dependent variable (Section 2.1).

[3] The Shirk & Ferreira (2015) report indicates that as of June 2015, 53% of municipalities had fully implemented the new system—with the remaining 47% having only partially implemented the reform or not implemented it at all.

[4] Baja California, Distrito Federal, Michoacan, and Sonora were assigned to the 'untreated' group. Appendix 4 considers results with different treatment baselines.

Additional regression plots were modeled with prosecution rate and clearance rate as the variables of interest to understand the determinant factors of a district attorney's decision to prosecute.

Atypical observations (outliers) were detected and considered through robust model diagnostics consistent with applied econometric approaches (Cook, 1977; Kannan Senthamarai and Manoj, 2015; Oesterreich, 2020).[5] Outliers were not omitted from analysis as the variables of interest did not differ significantly when outliers were excluded.

D. Endogeneity

In the last decade, the field has shifted towards robust causal identification strategies, with the importance of theory being largely defined by empirical techniques (Harris et. al., 2022). To that extent, this paper makes attempts to tackle endogeneity through a difference-in-differences (DID) approach. DID has been vastly employed to evaluate treatment effects (Borusyak and Jaravel, 2017; Athey and Im-bens, 2018). Recent literature has shown that when treatment is staggered and effects vary over groups and across time, the usual 2x2 DID approach may not be as effective (Goodman-Bacon, 2018; de Chaisemartin and D'Haultfœuille, 2020; Imai and Kim, 2020; Sun and Abraham, 2020; Gardner, 2021; Cunningham, 2021), however the *wide variety* in the adoption of treatment by Mexican states (2004; 2007; 2008; 2009; 2010; 2011; 2012; 2013; 2014; 2015; and 2016) paired with the limited data available for analysis made the task of determining pre-treatment parallel trends using Bacon's staggered treatment approach *extremely* complicated. As such, the standard, 2x2, DID approach was used with the treated states (pre-2015) as the intervention group and untreated states (post 2015)[6] as the counterfactual. The 2x2 difference-in-differences treatment effect is given by differencing the sample means for the intervention group; differencing the after minus before sample mean for the counterfactual; and then differencing the intervention and counterfactual terms (H). Formally;

$$\hat{\delta}_{kU}^{2x2} = \left\{\left(\bar{y}_k^{post(k)} - \bar{y}_k^{pre(k)}\right) - \left(\bar{y}_U^{post(k)} - \bar{y}_U^{pre(k)}\right)\right\} \qquad \text{(H)}$$

where:

k = intervention

U = counterfactual

pre(k) = before 2015

[5] Setting Cook's distance at 4/n, 13 highly influential observations were found for the case backlog model and 3 for appeal rates. Using the more conservative standard, Cooks = .5, we were left with 3 highly influential observations for the case backlog model and none for appeal rates (See Appendix 5).

[6] Though the states *do* eventually get treated in the following two years, since the data doesn't go further than 2018, we can assume for the purposed of analysis that given treatment lags these changes won't be reflected in our data—

This is not the most robust approach, staggered DiD would provide better and more robust results.

post(k) = after 2015

$\bar{y}$ = group means

III. Results

I found no significant relationship between states that adopted the adversarial system prior to 2015 and state level appeal rates. Conversely, statistically significant *attenuations in case backlog* were revealed. States that adopted the adversarial system of justice before 2015 saw their case backlogs rise by 13, 216 additional cases (See next page). This relationship is robust after controlling for crime and two-way fixed effects. Although the treatment line was chosen at 2015, OLS models included in Appendix 4 show treated states will experience significant rises in case backlog ranging from thirteen to fifty thousand cases regardless of when the treatment baseline is set.

Fig 2. Quality of Convictions and Length of Proceedings OLS/FE Results

	Dependent variable:							
	Case Backlog (L)				Appeal Rate (Q)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment Group	2,949.404	2,960.565	1,566.527	13,216.040***	1.134	1.136	1.321	2.809
	(3,374.312)	(3,385.711)	(2,419.722)	(3,941.382)	(1.964)	(1.950)	(2.038)	(3.710)
Clearance Rate		-1,300.247	-1,671.031	-3,184.550*		-2.132*	-2.323*	-0.212
		(2,035.180)	(1,616.643)	(1,710.712)		(1.172)	(1.362)	(1.610)
Prosecution Rate		-3,068.010	590.562	3,673.942		-12.166*	-13.770*	-13.674*
		(11,061.430)	(8,472.566)	(7,668.673)		(6.372)	(7.137)	(7.218)
State Income			-0.004*	-0.020			-0.00000	0.00001
			(0.002)	(0.014)			(0.00000)	(0.00001)
Complaints Filed			0.058***	-0.029			-0.00000	0.00000
			(0.021)	(0.023)			(0.00002)	(0.00002)
Homicide			1.790*	2.879*			-0.0004	-0.001
			(0.923)	(1.475)			(0.001)	(0.001)
Victimization			-0.003	-0.027***			-0.00000	-0.00000
			(0.002)	(0.003)			(0.00000)	(0.00000)
Cases Solved			0.660***	0.345*			-0.0001	-0.0002
			(0.178)	(0.196)			(0.0001)	(0.0002)
Appeals Solved			1.012**	0.879			0.0004	0.0002
			(0.403)	(0.559)			(0.0003)	(0.001)
Constant	12,970.000***	14,096.350***	1,842.400		0.864	3.549*	4.610**	
	(2,404.696)	(3,162.346)	(2,581.109)		(1.409)	(1.834)	(2.172)	
TWFE	NO	NO	NO	YES	NO	NO	NO	YES
Observations	241	241	235	235	241	241	235	235
R^2	0.003	0.005	0.334	0.782	0.001	0.023	0.042	0.441
Adjusted R^2	-0.001	-0.008	0.307	0.727	-0.003	0.011	0.004	0.302

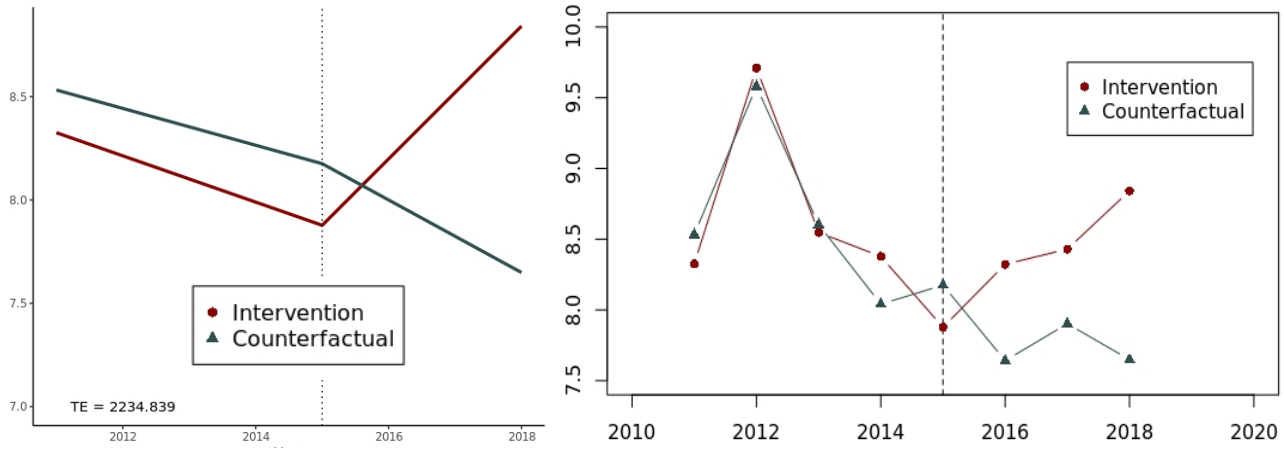
Note: Models 1 and 5 consider treatment group (Treated 2015) as the only parameter. Models 2 and 6, add control parameters for the clearance rate (X_2) and the rate of prosecution (X_3). Models 3 and 7 consider additional controls (state income, complaints filed, homicide, victimization, cases solved, and appeals solved)—denoted as X_i ; $i \in 4{:}9$ respectfully). Models 4 and 8, are a two-way fixed effects version of models 3 and 7(denoted as i,t) (See Appendix. 3). Appendix 4 considers how coefficients change as the treatment baseline varies.

Significance is denoted by *p<.01; **p<.05; ***p<.01

A. Difference-in-differences

Having established a statistically significant relationship between treated states and their case backlog, I now turn to the issue of endogeneity. Appeal rates were excluded from causal analysis as this metric did not enter any of the OLS models significantly. Treatment effects for case backlog was found to be about 2234 additional mean cases for states that were in the intervention/treated group. Visual DiD analysis (Figure 1 and 2) confirmed the findings of the OLS models—treated states have higher mean case backlogs.

Fig. 3 Log Backlog, Group Means, and DiD Trends Pre and Post-Treatment



Note: While the parallel trends assumption has been found to be neither necessary nor sufficient (Cunningham, 2021; Khan-Lang & Lang, 2019), this assumption holds as demonstrated by these figures. Counterfactual and intervention groups are observed to almost perfectly parallel trends prior to treatment with states receiving treatment breaking from the trend and overcoming the mean case backlog of the untreated states after 2015.

B. The Decision to Prosecute

Although no statistically significant treatment effect on appeal rates was revealed, we see the only factor significantly affecting the rate of appeals after controls and TWFE (See Table 1) was the rate of prosecution—an additional OLS TWFE model sought to understand the factors that play into the rate of prosecution, or more simply, what makes a prosecutor institute criminal proceeding (See Appendix 6). After controlling for the rate of crime reporting, defined as the number of criminal complaints made divided by the predicted number of total crimes, I find being a treated state corresponds to a .146 percent increase in the rate of prosecution. Similarly, prosecutors seem to weigh in clearance and appeal rates when deciding whether or not to prosecute. Results indicate prosecutors are relatively insensitive to the homicide rate. Creating indicator variables for each state, we

see that the decision to prosecute is heavily influenced by the state in question, even after controlling for state income.

IV. Discussion

Having empirically assessed the treatment effects of Mexico's New Criminal Justice System, I now turn to making sense of them from a theoretical framework. Recalling model D (See Section 2.1 at page 5), the analysis was framed as an optimization problem seeking to maximize the quality of convictions but minimizing the length of proceedings.

$$\max_{f_A, f_I} Q(f_A, f_I, pr) - L(f_A, f_I,\ pr, cr) \tag{D}$$

Case backlog was correctly estimated to be influenced by the clearance rate (cr) and the system under which a case is filed. Although appeal rates (Q) did not reveal a significant response to treatment, we learned that it was significantly influenced by the rate at which prosecutors initiate proceedings against defendants (pr). The fact that the cost term is larger under the new system favors Gordon Tullock's point, the nature of adversarial trials incentivizes both parties to actively work against each other, obscuring evidence from each other, making the truth finding process longer at the expense of conviction quality—thus both administrative and error costs are higher under the new system. Formally;

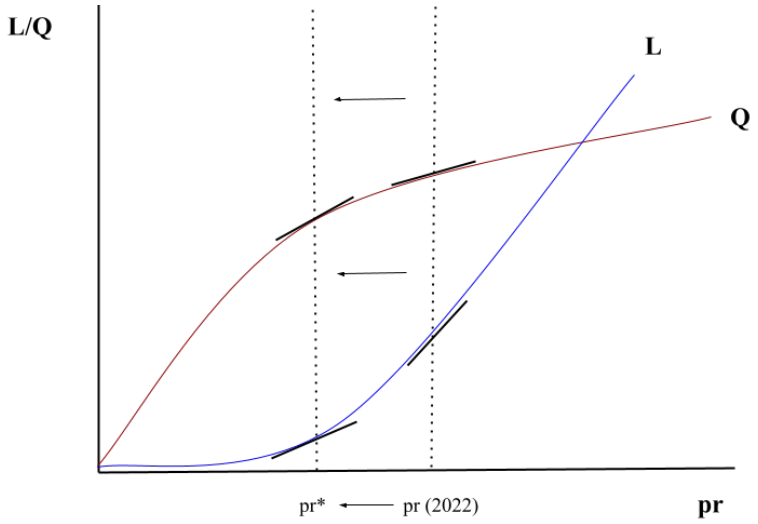
$$\frac{\partial Q}{\partial f_A} <<< 0$$

$$\frac{\partial L}{\partial f_A} >>> 0$$

But Tullock should not crown himself victor quite yet, although backlog *was* higher, the quality of convictions has not been significantly altered—pointing to the fact that the cost term (L) is yet to achieve optimality conditions before it can significantly affect (Q). Once L* is achieved, there will be two plausible outcomes, (1) L* will be higher than it is now, even further and affect the quality of convictions negatively. (2) L* will be lower than it is currently and the quality of convictions will improve, the rights of the accused will be safeguarded, and Posner will be able to sleep. Another important finding is the fact that the rate of prosecution *does* affect both terms meaning that it will play an important role in allowing Q and L to reach optimal levels.

Graphically;

Fig.4 Model Optimality Conditions



A. Additional Considerations

> "The spaces where hearings occurred in the old system were ill-equipped to provide fair trials for defendants. Bearing little resemblance to the stereotypical, wood paneled court rooms seen on television, trials in the old system occurred in hectic, Kafkaesque office spaces—a foreign visitor would be shocked to realize that this was the place where [justice took] place."
>
> (NCJS—Before & After)

Though the new system sought to overhaul these practices, police, attorneys, judges, and defendants remain largely wedded to the old system. The challenges currently faced by Mexico after this institutional reform can be explained by path dependence literature. The justice system is by no means shielded from the effects of path dependence. In studying the effects of mass incarceration in the United States, path dependency has been found to be largely responsible for the general public's reluctance to reduce sanctions for less severe offenses (Beckett, 2018). As of 2015, the general public had no idea of the reform the system was undergoing. A survey conducted in 2013, 3 years shy of the deadline, found only 11% of Mexico's citizens and 30% of Mexico's attorneys were aware of the reform (Shirk & Rodriguez Ferreira, 2015). Breaking down the various actors of the criminal justice system, we can understand what is happening.

i. Police and Prosecutors

For a long time, the widespread use of coerced statements was the sole basis for incrimination, which in turn reduced the prosecutor's responsibility to produce better evidence against the accused (González-Núñez, 2018; Kuckerts, 2020). This favored prosecuting attorneys, as the old system required them to prosecute each case to cross their desk and were prohibited from withholding prosecution of cases they considered to be of little importance. Deficient procedural rights provided both police and prosecuting attorneys large leeway and incentives to produce coerced evidence. Although mandated prosecution and coerced confessions were banned under the new system, police and prosecutors still need a way to investigate—largely untrained, understaffed, and chronically underfunded, it's no surprise that cases are taking longer to solve when police and prosecuting attorneys don't have better investigative tools to look to. As police develop better techniques of investigation and prosecutors develop a better sense of prosecutorial discretion, we might see case backlog drop and quality of convictions increase.

ii. Police and Prosecutors

Courtrooms too are underfunded and judges untrained. Remedial measures were underway as of 2015 when Mexico received grants from the U.S. State Department's Bureau of International Narcotics and Law Enforcement to provide law faculty and law students training and oral trial skills (Reforms, 2016). Because the data examined ranged up to 2018, it's likely the benefits of these types of training efforts were unrevealed by the data— it might be a while before we observe any substantive results.

V. Conclusion

Robust empirical results revealed Mexico's implementation of oral adversarial criminal procedures to be detrimental to metrics of judicial efficiency—with states implementing the reform seeing a significant increase in their case backlogs as predicted by Gordon Tullock, a critic of the common law. Although this might be discouraging to advocates of adversarial procedures—such as Judge Posner, theory suggests this backlog increase is merely a result of path dependency, suboptimal levels of prosecutorial discretion, and poor investigative techniques. The adapted version of Becker's (1968) model suggests Mexico will live up to the standards of justice intended by the Congressional initiative once optimality is reached. As Mexico continues on its journey towards a just future, it is in its best interest to ensure the momentum of this effort is not lost. As for the long-standing Tullock-Posner debate, the empirical findings of this study, combined with Becker's adapted model, and path dependency theory tilt the scales of victory towards Posner. Only time will tell.

Acknowledgements

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Appendix. 1 State ID, Treatment Group, and Year Treated

State ID	State Name	Treated 2015	Year Treated	State ID	State Name	Treated 2015	Year Treated
1	Aguascalientes	1	2014	17	Morelos	1	2008
2	Baja California	1	2010	18	Nayarit	1	2014
3	Baja California Sur	0	2016	19	Nuevo Leon	1	2004
4	Campeche	1	2014	20	Oaxaca	1	2007
5	Coahuila	1	2013	21	Puebla	1	2013
6	Colima	1	2014	22	Queretaro	1	2014
7	Chiapas	1	2013	23	Quintana Roo	1	2014
8	Chihuahua	1	2007	24	San Luis Potosi	1	2014
9	Distrito Federal	0	2015	25	Sinaloa	1	2014
10	Durango	1	2009	26	Sonora	0	2016
11	Guanajuato	1	2011	27	Tabasco	1	2012
12	Guerrero	1	2014	28	Tamaulipas	1	2014
13	Hidalgo	1	2014	29	Tlaxcala	1	2014
14	Jalisco	1	2014	30	Veracruz	1	2013
15	Mexico	1	2009	31	Yucatan	1	2011
16	Michoacan	0	2015	32	Zacatecas	1	2009

Appendix 2. Correlation Matrix

	Case Backlog	Appeal Rate	Clearance Rate	Prosecution Rate	Cases/Appeals Filed (Adv)	Cases/Appeals Filed (Inq)	Treatment 2014	State Income	Complaints Filed	Homicide	Victimization	Total Cases Filed	Total Appeals Filed
Case Backlog	1	-0.075	-0.037	-0.006	0.027	-0.027	0.108	0.404	0.453	0.328	0.258	0.320	0.445
Appeal Rate	-0.075	1	-0.082	-0.091	-0.096	0.096	-0.097	-0.073	-0.060	-0.065	-0.038	-0.080	-0.014
Clearance Rate	-0.037	-0.082	1	-0.314	0.077	-0.077	-0.081	-0.012	-0.053	0.035	0.065	-0.242	-0.101
Prosecution Rate	-0.006	-0.091	-0.314	1	-0.239	0.239	0.006	-0.096	-0.149	-0.131	-0.129	0.662	0.041
Cases/Appeals Filed (Adv)	0.027	-0.096	0.077	-0.239	1	-1	0.318	0.100	0.177	0.314	0.239	-0.067	-0.306
Cases/Appeals Filed (Inq)	-0.027	0.096	-0.077	0.239	-1	1	-0.318	-0.100	-0.177	-0.314	-0.239	0.067	0.306
Treatment 2014	0.108	-0.097	-0.081	0.006	0.318	-0.318	1	0.094	0.220	0.173	-0.034	0.157	-0.088
State Income	0.404	-0.073	-0.012	-0.096	0.100	-0.100	0.094	1	0.736	0.383	0.476	0.451	0.681
Complaints Filed	0.453	-0.060	-0.053	-0.149	0.177	-0.177	0.220	0.736	1	0.571	0.654	0.457	0.548
Homicide	0.328	-0.065	0.035	-0.131	0.314	-0.314	0.173	0.383	0.571	1	0.406	0.247	0.266
Victimization	0.258	-0.038	0.065	-0.129	0.239	-0.239	-0.034	0.476	0.654	0.406	1	0.331	0.244
Total Cases Filed	0.320	-0.080	-0.242	0.662	-0.067	0.067	0.157	0.451	0.457	0.247	0.331	1	0.484
Total Appeals Filed	0.445	-0.014	-0.101	0.041	-0.306	0.306	-0.088	0.681	0.548	0.266	0.244	0.484	1

Mathematical Appendix 3. OLS/FE Models

$$Backlog = \beta_0 + \beta_1(Treated\ 2014) + \in \quad (1)$$

$$Backlog = \beta_0 + \beta_1(Treated\ 2014) + \beta_2 X_2 + \beta_3 X_3 + \in \quad (2)$$

$$Backlog = \beta_0 + \beta_1(Treated\ 2014) + \beta_2 X_2 + \beta_3 X_3 \ldots + \beta_9 X_9 + \in \quad (3)$$

$$Backlog_{it} = \beta_0 + \beta_1(Treated\ 2014)_{it} + \beta_2 X_{2\mathrm{it}} + \beta_3 X_{3\mathrm{it}} \ldots + \beta_9 X_{9it} + \alpha_{it} \ \in_{it} \quad (4)$$

$$Appeals\ Rate = \beta_0 + \beta_1(Treated\ 2014) + \in \quad (5)$$

$$Appeals\ Rate = \beta_0 + \beta_1(Treated\ 2014) + \beta_2 X_2 + \beta_3 X_3 + \in \quad (6)$$

$$Appeals\ Rate = \beta_0 + \beta_1(Treated\ 2014) + \beta_2 X_2 + \beta_3 X_3 \ldots + \beta_9 X_9 + \in \quad (7)$$

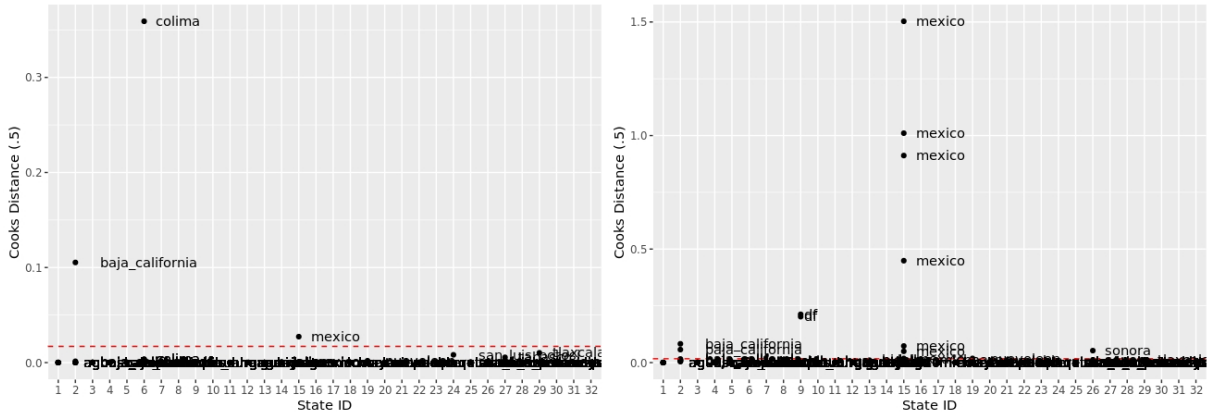
$$Appeals\ Rate_{it} = \beta_0 + \beta_1(Treated\ 2014)_{it} + \beta_2 X_{2\mathrm{it}} + \beta_3 X_{3\mathrm{it}} \ldots + + \beta_9 X_{9it} + \alpha_{it} \ \in_{it} \quad (8)$$

Appendix 4. Quality of Convictions and Length of Proceedings by Varying Treatment Baseline

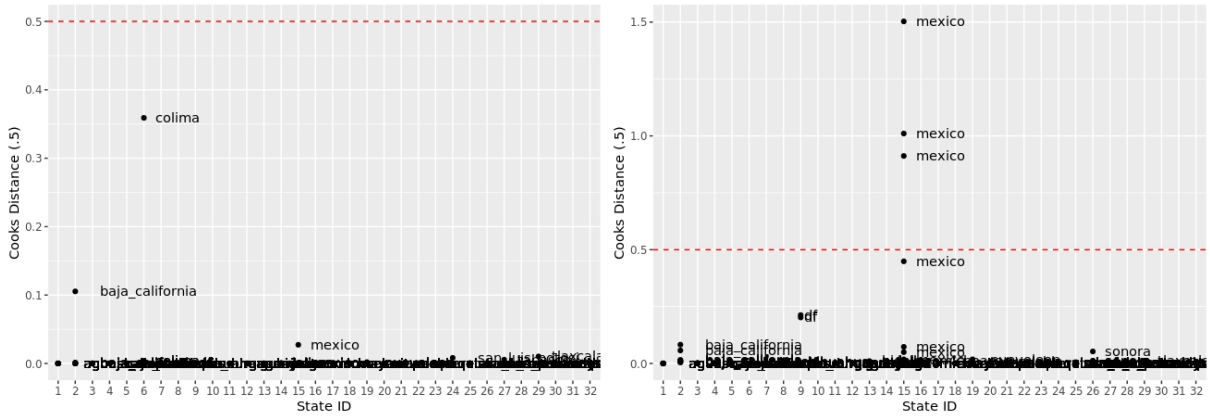
	Dependent variable:							
	Case Backlog (L)				Appeal Rate (Q)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated 2007	2,815.125	2,898.340	1,420.776	25,727.470***	0.647	0.678	-0.723	3.942
	(5,274.728)	(5,290.545)	(4,632.504)	(5,006.330)	(3.321)	(3.294)	(3.930)	(4.712)
Treated 2008	-5,883.000	-6,468.569	-993.046	19,524.830***	-0.175	-0.990	-2.929	1.727
	(6,578.741)	(6,625.348)	(5,820.708)	(4,719.343)	(4.143)	(4.125)	(4.938)	(4.442)
Treated 2009	10,964.740**	10,910.840**	5,360.995	13,216.040***	0.030	-0.208	-1.707	2.809
	(5,000.015)	(5,018.895)	(4,662.416)	(3,941.382)	(3.148)	(3.125)	(3.955)	(3.710)
Treated 2010	10,814.380*	11,366.260*	4,072.708	52,484.400***	1.042	1.522	0.236	5.879
	(6,090.731)	(6,159.825)	(5,489.965)	(8,834.552)	(3.835)	(3.835)	(4.657)	(8.315)
Treated 2011	-31.625	-300.088	1,280.340	16,653.130***	0.355	-0.102	-2.277	1.729
	(5,274.728)	(5,296.093)	(4,527.677)	(4,251.868)	(3.321)	(3.297)	(3.841)	(4.002)
Treated 2012	2,756.750	3,188.409	7,404.740	32,390.680***	0.548	1.010	-1.264	1.812
	(6,090.731)	(6,130.527)	(4,980.897)	(7,880.015)	(3.835)	(3.817)	(4.226)	(7.417)
Treated 2013	221.156	-294.833	2,346.380	55,221.200***	1.197	0.176	-2.140	2.937
	(4,815.146)	(4,873.901)	(4,227.920)	(11,615.280)	(3.032)	(3.034)	(3.587)	(10.933)
Treated 2014	-1,424.579	-1,484.239	2,223.827	14,616.930***	2.518	2.370	-0.007	2.614
	(4,484.471)	(4,496.880)	(4,071.436)	(3,994.722)	(2.824)	(2.800)	(3.454)	(3.760)
Treated 2015	15,441.920***	15,185.350***	4,835.658	38,565.500***	0.717	0.196	-1.413	3.583
	(5,473.844)	(5,498.344)	(4,702.179)	(6,836.928)	(3.447)	(3.423)	(3.989)	(6.435)
Treated 2016	-982.812	-1,084.849	946.087	35,141.790***	0.267	-0.015	-2.136	2.741
	(5,274.728)	(5,292.784)	(4,550.081)	(8,288.343)	(3.321)	(3.295)	(3.860)	(7.801)
Clearance Rate		-904.129	-1,789.657	-3,184.550*		-2.417**	-2.515*	-0.212
		(1,943.160)	(1,675.707)	(1,710.712)		(1.210)	(1.422)	(1.610)
Prosecution Rate		-10,003.930	-3,706.707	3,673.942		-13.875**	-15.295**	-13.674*
		(10,858.260)	(8,976.009)	(7,668.673)		(6.760)	(7.615)	(7.218)
Constant	6,590.000	8,292.680*	39.725		0.395	3.807	6.874*	
	(4,306.797)	(4,875.972)	(4,565.770)		(2.712)	(3.036)	(3.873)	
Controls	NO	NO	YES	YES	NO	NO	YES	YES
Fixed Effects	NO	NO	NO	YES	NO	NO	NO	YES
Observations	241	241	235	235	241	241	235	235
R^2	0.163	0.166	0.352	0.782	0.018	0.044	0.056	0.441
Adjusted R^2	0.127	0.122	0.299	0.727	-0.024	-0.006	-0.023	0.302

Note: Significance is denoted by *p<.01; **p<.05; ***p<.01

Appendix . 5(a) Cook's Distance Plots (4/n)
(Appeal Rate on left, Backlog on right)



Appendix . 5(b) Cook's Distance Plots (.5)
(Appeal Rate on left, Backlog on right)



Appendix 6. Prosecution Rate OLS/FE Results

	Dependent variable:		
	Prosecution Rate (pr)		
	(1)	(2)	(3)
Treated 2015	-0.002	-0.003	0.146***
	(0.020)	(0.012)	(0.023)
Clearance Rate	-0.058***	-0.022***	-0.017***
	(0.011)	(0.007)	(0.006)
Cases Filed		0.00001***	0.00001***
		(0.00000)	(0.00000)
State Income		-0.00000***	0.00000***
		(0.000)	(0.00000)
Case Backlog		-0.00000	-0.00000*
		(0.00000)	(0.00000)
Appeal Rate		-0.001*	-0.001*
		(0.0004)	(0.0004)
Homicide		-0.00001*	0.00000
		(0.00000)	(0.00001)
Victimization		-0.00000***	-0.00000***
		(0.000)	(0.00000)
Crime Reporting Rate		-0.315***	-0.568***
		(0.112)	(0.163)
Constant	0.135***	0.136***	
	(0.021)	(0.021)	
TWFE	NO	NO	YES
Observations	241	241	241
R^2	0.099	0.728	0.935
Adjusted R^2	0.091	0.717	0.920
Note:		*p<0.1; **p<0.05; ***p<0.01	