DISTRICT COURT CASELOAD FORECASTING

An Executive Summary

A REPORT PREPARED BY THE RESEARCH DIVISION

OF

THE FEDERAL JUDICIAL CENTER

WASHINGTON, D. C.

OCTOBER 1975

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The judiciary's need to forecast changes in demand for court services is an ongoing one. Prior efforts to predict caseloads have been based upon trend extrapolations and have proved unsatisfactory; predictions usually fell far short of actual experience. In 1973, the Federal Judicial Center entered a contract with Battelle Pacific Northwest Laboratories for the development of caseload forecasting models for federal district courts. This is a summary of the project's first stage, which is now complete.

Forecasts have been developed for a set of 42 civil and criminal categories that today comprise approximately 80 percent of federal district court filings. This set of forecasts has been generated for each of 88 district courts within the fifty states.* Additional sets of forecasts have been generated for each circuit and for the nation as a whole. The forecasts are fixed for 1979, 1984 and 1995, although computations for other years are still feasible.

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*Forecasts were not developed for the Districts of Guam, the Virgin Islands, Puerto Rico, and the Canal Zone. The four districts in California were reduced to two districts in order to generate comparable caseload data over a sufficient period for the modelling effort. The two California districts reflect the distribution of federal court business as if the creation of two new districts in 1967 had not occurred. Insufficient caseload data from the Middle District of Louisiana, which was created in 1972, prevented the development of forecasts.

How the Forecasts Were Derived

The forecasts were derived from models of yearly case filing activity in the district courts over the 21-year period, 1950--1970. A model is a mathematical equation relating case filing volume with one or more variables.

Two types of models were used to generate forecasts. One was based on the premise that case filing volume in a given year can be described in terms of the case filing activity observed in preceding periods. This is known as an autoregressive model. The other model is based on the premise that case filing volumes from one year to the next can be described in terms of economic, demographic and social variables called indicators. This is known as an indicator-based model.

Both models assume that relationships and trends observed in the past will continue in the future. This assumption does not always prove adequate; the occurrence of particular events in the past have influenced case filing volumes in ways that could not have been anticipated from the case filing volumes or the indicators. The Supreme Court's decision in Fay v. Noia [372 US 391(1963)], the enactment of the 1964 Civil Rights Act, disillusionment over the Vietnam War are but a few examples of "surprise events" whose impact on court business could not have been anticipated from the autoregressive or indicator-based models alone.

The Center's forecasting effort improves substantially over past modelling efforts of any kind by an attempt to anticipate the "surprise events" of the future. Potential "surprise events" were identified and quantitatively described by people expert in the business of federal courts. The forecasts based on the autoregressive and indicator-based models were modified to account for the "surprises."

Case Categories Defined

The 42 categories of civil and criminal filings used in the forecasting effort can be found in Table One. Civil categories were measured by the number of cases. Criminal categories were measured by the number of defendants on the view that this number relates more closely to the workload of the courts and to the indicator variables than does the number of criminal cases. Of course, the number of criminal cases and the number of criminal defendants in those cases are highly correlated. The "Beginning Year" column indicates the earliest year for which case filing data are available from the Administrative Office of the United States Courts.

TABLE ONE

CASE CATEGORIES USED IN FORECASTING STUDY

CIVIL CASE CATEGORIES	
Beginning Year	Case Category
1968	Narcotics Addiction Rehabilitation Act*
1950	Fair Labor Standards Act*
1961	Social Security Laws*
1950	Tax laws*
1950	Food and Drug Act*
1955	Fraud*
1955	Fraud**
1950	Negotiable instruments*
1955	Foreclosure*
1950	Condemnation of Land*
1955	Civil Rights**
1955	Labor Management Relations Act**
1961	Securities, Commodities and Exchanges**
1955	Commerce**
1950	Patents, Copyrights and Trademarks**
1955	Anti-trust**
1950	Motor Vehicle Personal Injury**

* = U.S. cases

** = Private actions

TABLE ONE

CASE CATEGORIES USED IN FORECASTING STUDY

(Continued)

CIVIL CASE CATEGORIES	
Beginning Year	Case Category
1950	Marine Personal Injury**
1950	Employer's Liability Act**
1955	Airplane Personal Injury**
1955	Assault, Libel, and Slander**
1955	Marine Contract Actions**
1950	Insurance**
1950	Miller Act**
1954	Prisoner Petitions*
1955	Prisoner Petitions**

CRIMINAL CASE CATEGORIES	
Beginning Year	Case Category
1953	Selective Service Act
1950	Migratory Bird Laws
1950	Immigration Laws
1950	Auto Theft
1962	Transportation of Forged Securities
1960	Counterfeiting and Forgery
1960	Marijuana Tax Act
1960	Weapons and Firearms
1960	Escape

TABLE ONE

CASE CATEGORIES USED IN FORECASTING STUDY

(Continued)

CRIMINAL CASE CATEGORIES	
Beginning Year	Case Category
1960	Larceny and Theft (Postal and Interstate)
1960	Embezzlement (Postal and Bank)
1954	Income Tax Fraud
1960	Bank Robbery
1950	Liquor Laws (IRS)
1960	Assault
1960	Transportation of Stolen Property

* = U.S. cases

** = Private actions

N.B.: The development of a consistent data base for the civil case categories was complicated by the basis for jurisdiction (i.e., U.S. plaintiff, U.S. defendant, federal question, diversity of citizenship and local). In all but two case categories, one basis for jurisdiction dominated the filings and that was the one used for the data. The filings in the prisoner petition and fraud categories were distributed such that prisoner petition (U.S.), prisoner petition (private), fraud (U.S.), and fraud (private) were maintained and analyzed as separate case categories.

Contributions of the Advisory Committee

The success of this initial forecasting effort rests in large measure on the contribution of the Center's Advisory Committee on Forecasting. The composition of the Committee was achieved through consultation between the Federal Judicial Center and Battelle Pacific Northwest Laboratories. Each of the Committee members is an expert in some facet of federal court practice. The names of the seven Committee members are listed below along with their affiliations at the time of the Committee's activity.

Roger C. Cramton, Esq.
Dean, Cornell Law School

Mr. H. Stuart Cunningham
Clerk, U.S. District Court (N.D. Ill.)

Irving Jaffe, Esq.
Deputy Assistant Attorney General
Civil Division
Department of Justice

Nathaniel E. Kossack, Esq.
Project Director, NDAA Economic Crime
Prevention Centers

Silvio Mollo, Esq.
Chief Assistant U.S. Attorney (S.D.N.Y.)

The Honorable Alvin B. Rubin
Judge, U.S. District Court (E.D. La.)

Paul G. Urlich, Esq.
Lewis & Roca
Phoenix, Arizona

The Advisory Committee's contribution to the forecasting effort can be divided into two parts. The first consisted of developing a list of suggested indicators for individual case categories and then

estimating the utility of such indicators across case categories. These exercises helped to generate a number of indicators. Some suggestions could not be used because of a lack of relevant indicator data. Other indicators were added as a result of the Committee's suggestions and an attempt to find suitable surrogates for unavailable indicators. Some indicators were used in modelling both civil and criminal case filing data (listed below as "General Indicators"). Others were used only in criminal case modelling efforts (listed below as "Criminal Indicators"); still others were used only in the civil case modelling effort (listed below as "Civil Indicators"). The list of 158 indicators used in the study can be found in Table Two.

TABLE TWO

INDICATOR VARIABLES

GENERAL

1. American Bar Association Membership
2. Average Months Served by Prisoners in Federal Prisons
3. Average Months of Sentence of Federal Prisoners
4. Bar Members (Estimated)
5. Department of Justice Budget
6. Direct Per Capita Expenditures by State for Education
7. Dollar Value of Retail Sales
8. Dow Jones Industrial Averages

9. Federal Attorneys Allocated Each District
10. FBI Agents Assigned to Field Divisions
11. Federal Bureau of Investigation Budget
12. Federal Prison System Budget
13. Insured Unemployment Rates by States
14. Investigation Budget of the FBI
15. Median Age Within State
16. Median Age of Prisoners in Federal Prisons
17. Median Months to Trial in Civil Cases
18. Moody's Common Stock Averages
19. Parole and Mandatory Release Violators Returned
20. Percent of Population of Each State That is Black
21. Percent of Population Over 25 with at Least a High School Education
22. Percent of Retail Sales by States (Based on Total U.S. Sales)
23. Population 18-64
24. Prime Interest Rate (Prime Commercial Paper)
25. Ratio of Year-End Population to Planned Capacity of Prisons (as of August 1974)
26. Standard and Poor's 500 Composite Stock Index
27. Stocks Traded on all Stock Exchanges
28. Unemployment Rates
29. Unemployment Rates by States

CIVIL CASE CATEGORY

30. Annual Volume of Trading on Each Contract Market - Wheat in Bushels

31. Annual Volume of Trading on Each Contract Market - Corn in Bushels
32. Annual Volume of Trading on Each Contract Market - Oats in Bushes
33. Annual Volume of Trading on Each Contract Market - Rye in Bushels
34. Annual Volume of Trading on Each Contract Market - Soybean in Bushels
35. Annual Volume of Trading on Each Contract Market - Grain Sorghums in Pounds
36. Annual Volume of Trading on Each Contract Market - Cotton in Bales
37. Annual Average Seafaring Jobs
38. Average Hours of Overtime Work in Manufacturing
39. Bankruptcies Filed
40. Blue Cross, Blue Shield and Medical Society Plans
41. Budget of the Antitrust Division of the Department of Justice
42. Cases Filed in U.S. Court of Claims
43. Cases Filed in U.S. Tax Court
44. Cases Reneged in U.S. Tax Court
45. Cases Terminated in U.S. Court of Claims
46. Casualties to Commerical Vessels
47. Claims Filed With Social Security Administration
48. Coast Guard Personnel on Active Duty
49. Collisions to Commerical Vessels
50. Commission on Civil Rights Budget
51. Contract Life Insurance - Dollar Value of Policies in Force
52. Deaths in Motor Vehicle Accidents
53. Department of Health, Education and Welfare Budget
54. Department of Labor Budget
55. Direct Per Capita Expenditures by State for Highways

56. Direct Per Capita Expenditures by State for Public Welfare
57. Dollar Value of Automobile Liability Insurance Premiums
58. Dollar Value of Emergency Disaster Loans
59. Dollar Value of Exports
60. Dollar Value of Federal Housing Administration Loans Secured by Mortgages
61. Dollar Value of Federal Land Banks Loans Secured by Mortgages
62. Dollar Value of Fire and Casualty Insurance Premiums
63. Dollar Value of Imports
64. Dollar Value of Loans Outstanding - Farmers Home Loan Association
65. Dollar Value of New Federal Government Construction
66. Dollar Value of Old-Age, Survivors, Disability Insurance Disallowances by Social Security Administration
67. Dollar Value of Premiums on Ocean Marine Insurance
68. Dollar Value of Property Acquired by Direct Purchase and Condemnations by Federal Government
69. Dollar Value of Small Business Administration Loan Defaults
70. Dollar Value of Small Business Administration Loans Secured by Mortgage
71. Dollar Value of Small Business Administration Loans Outstanding
72. Dollar Value of United States Economic and Military Foreign Aid
73. Dollar Value of Veterans Administration Loans Secured by Mortgages
74. Dollar Volume of Welfare Payments
75. Estimated Dollar Cargo Loss - Due to Collisions of Commercial Vessels
76. Estimated Dollar Loss - Commercial Vessels Due to Collisions
77. Estimated Dollar Loss - Property, Due to Collisions
78. Federal Aviation Administration Budget
79. Federal Trade Commission Budget

80. Federal Outlay for Alcoholic and Addict Rehabilitation
81. Food and Drug Administration Budget
82. Health Insurance Companies Licensed
83. Highway Miles (Municipal and Rural)
84. Income Tax Collected by Internal Revenue Service
85. Income Tax Returns
86. Income Tax Claims for Refund - Claimed by Taxpayer
87. Income Tax Refund Claims Allowed by Internal Revenue Service
88. Independent Health Plans Licensed
89. Individuals Covered by Social Security
90. Internal Revenue Service Budget
91. Interstate Commerce Commission Budget
92. Life Insurance Companies
93. Maritime Administration Budget
94. Most Active Book Publishers in Literary Marketplace
95. National Labor Relations Board Budget
96. People Under Age 65 Protected by Hospital Medical Expense
97. People Under Age 65 Protected by Surgical Medical Expense
98. People Under Age 65 Protected by Regular Medical Expense
99. Percent of Illnesses Reported (Based on Annual Average Seafaring Jobs)
100. Percent of Injuries Reported (Based on Annual Average Seafaring Jobs)
101. Percent of Registered Voters that are Black
102. Private Anti-Trust Civil Cases Filed
103. Private Anti-Trust Civil Cases Terminated

104. Private Anti-Trust Civil Cases, Percent Reaching Trial
105. Private Anti-Trust Civil Cases Pending
106. Private Bankruptcies Filed in Federal District Court
107. Residents with Adjusted Gross Income $\geq$ $100,000/yr.
108. Robbery, Burglary, Larceny by State
109. Security and Exchange Commission Budget
110. Social Security Administration Budget
111. Strikes (Work Stoppages)
112. Total Estimated Dollar Losses - Commercial Vessels
113. Total Estimated Dollar Cargo Losses - Commercial Vessels
114. Total Estimated Dollar Property Losses - Due to Casualties to Commercial Vessels
115. Union Members
116. U.S. Flag Merchant Vessels Employees
117. Vessels Entering Directly From Foreign Ports
118. Wage and Labor Standard Budget
119. Waterborne Imports, Cargo Tonnage
120. Waterborne Exports, Cargo Tonnage

CRIMINAL CASE CATEGORY

121. Appraised Value of Property Seized
122. Arrests for Liquor Law Violations
123. Automobiles Seized
124. Average Number of Prisoners for Drug Law Violations

125. Average Sentence for First Releases for Drug Law Violation in Months

126. Average Time Served by First Releases for Drug Law Violations in Months

127. Bills Filed in Congress for Individual Immigrants

128. Budget of the Alcohol, Tobacco and Firearms Division of the Department of the Treasury

129. Domestic Production and Imports of Firearms for Private Sale

130. Immigration and Naturalization Service Budget

131. Male Population Age 15-24

132. Median Months From Filing to Disposition of Criminal Defendants Disposed of in Fiscal Year

133. Men Inducted by Selective Service System

134. Military Population of the United States

135. Motor Vehicle Registrations

136. Number of Farm Labor Migrant Workers

137. New Narcotics Addicts - Under 21

138. New Narcotics Addicts - Age 21-30

139. New Narcotics Addicts - Age 31-40

140. New Narcotics Addicts - Age 41 and Over

141. New Narcotics Addicts - Caucasian

142. New Narcotics Addicts - Black

143. New Narcotics Addicts - Not Caucasian or Black

144. Number of Individuals Deported

145. Other Vehicles Seized

146. People Crossing Land Borders by State

147. Pounds of Cocaine Removed From Market.

148. Pounds of Heroin Removed From Market

149. Pounds of Marijuana Removed From Market

150. Selective Service System Budget

151. Stills Confiscated

152. Stolen Vehicles

153. Tax Per Gallon on Distilled Spirits

154. Wage Differential for Agricultural Workers Per Day Between United States and Mexico

155. Wine Gallons of Distilled Spirits Seized

156. Wine Gallons of Mash Confiscated

157. Wine Gallons of Other Liquors Seized

158. United States Wage Rate for Agricultural Workers

The second contribution of the Advisory Committee was directed to the estimation of "surprise events" and their potential impacts on the case categories in the forecasting study. Potential "surprises" were identified through a poll of chief legal officers of all U.S. government departments. One lawyer in every state, drawn from a list of Fellows of the American Bar Foundation, was also contacted. These individuals were asked to identify future events likely to affect each of the 42 case categories in Federal courts in each of three time periods: 1975-1979, 1980-1984, 1985-1995. Forty-two attorneys (out of 159) completed the questionnaires. Review of these responses plus suggestions from the Advisory Committee resulted in the development of a set of 33 "surprise events" for which probability estimates were assessed. This set represents one view of the future. It is dependent upon the experiences of the people who responded to the questionnaire and upon the people who served on the Advisory Committee.

As to method, the Advisory Committee spent considerable time discussing the "surprise events" and their potential influence on case filings. Discussions generally dealt with such factors as:

(1) Pressures existing today that could result in legislation modifying case filings in federal court (e.g., consumer protection, regulation of land use, regulation of firearms, etc.)

(2) The development of administrative alternatives as a solution to large case backlogs in the courts (e.g., non-judicial handling of prisoner complaints)

(3) Changes that make the courts more (or less) accessible to a larger proportion of the population (e.g., relaxation of class action requirements, legal assistance to the poor, prepaid legal insurance, restriction of diversity jurisdiction, etc.)

(4) Action within the court system (or possibly Congress) that alters the business of the district courts (e.g., transfer of appellate court business to the district courts)

(5) Pervasive events that would influence most aspects of society (e.g., economic depression, war, etc.)

These discussions were then translated into numerical estimates of probability for each of the 33 "surprise events." The probability values ranged from 0 (for a highly improbable occurrence) to 100 (for a highly probable occurrence). The median probability estimates generated by the Advisory Committee for each event in each of the time intervals can be found in Table Three. These values reflect estimates of the onset of each event, i.e., the probability that such an event will indeed begin in a given time period.

TABLE THREE

SUMMARY OF "SURPRISE EVENT" PROBABILITY ESTIMATES

	"SURPRISES"	1975-1979	1980-1984	1985-1995
1.	Reduction in prison populations	15.0	32.5	45.0
2.	Increases in non-judicial handling of prisoner complaints	42.5	55.0	70.0
3.	Limitations on availability of Federal habeas corpus	52.5	42.5	27.5
4.	Further expansion of government tort liability	55.0	65.0	55.0
5.	Relaxation of class action requirements	32.5	40.0	40.0
6.	Increased legal assistance to welfare and low income groups	60.0	60.0	50.0
7.	Expansion of provisions for attorney fee recovery	55.0	60.0	55.0
8.	Increased decriminalization of drug use	50.0	70.0	75.0
9.	Increased government role in regulating labor conditions	42.5	50.0	55.0
10.	No-fault auto insurance	80.0	60.0	40.0

TABLE THREE

SUMMARY OF "SURPRISE EVENT" PROBABILITY ESTIMATES

(Continued)

	"SURPRISES"	1975-1979	1980-1984	1985-1995
11.	National medical insurance	45.0	72.5	80.0
12.	Restriction of diversity jurisdiction	40.0	50.0	55.0
13.	Increase of $10,000 requirement in Tucker Act cases	50.0	47.5	50.0
14.	Changed travel patterns due to travel costs (mass travel subsidation)	40.0	65.0	60.0
15.	Widespread prepaid legal insurance	37.5	62.5	70.0
16.	Reduction in the physical transfer of financial paper and negotiable instruments	55.0	70.0	70.0
17.	Simplification of Federal income tax structure	22.5	40.0	50.0
18.	Economic depression	50.0	50.0	40.0
19.	Marked acceleration in inflation	55.0	32.5	42.5
20.	Substitution of compensation system for transportation workers	45.0	50.0	45.0

TABLE THREE

SUMMARY OF "SURPRISE EVENT" PROBABILITY ESTIMATES

(Continued)

	"SURPRISES"	1975-1979	1980-1984	1985-1995
21.	Removal of business from appellate courts to district courts	60.0	50.0	55.0
22.	Introduction of mandatory arbitration	30.0	55.0	42.5
23.	Increased regulations of firearms	50.0	60.0	65.0
24.	Increased consumer protection legislation	65.0	62.5	60.0
25.	Elimination of district court review of land use	20.0	50.0	45.0
26.	Increased Federal regulation of land use	60.0	70.0	65.0
27.	Legislation increasing environmental protection	60.0	70.0	70.0
28.	Increased Federal regulations on energy and resources	85.0	75.0	55.0
29.	Energy resource shortage (cases resulting from an inability to meet contractual obligations)	70.0	72.5	35.0

TABLE THREE

SUMMARY OF "SURPRISE EVENT" PROBABILITY ESTIMATES

(Continued)

	"SURPRISES"	1975-1979	1980-1984	1985-1995
30.	Urban development or rural decentralization(Federal money as vehicle)	65.0	60.0	55.0
31.	Occurrence of major national hostilities	25.0	40.0	37.5
32.	Massive increases in leisure time	50.0	60.0	60.0
33.	Medical improvements resulting in a much older population	40.0	47.5	70.0

Two competing concerns had to be carefully balanced in this exercise. If surprise events are defined in general terms (e.g., medical improvements resulting in a much older population), then it is relatively easy to estimate the probability of occurrence but very difficult to assess impact. But if events are specific (e.g., adoption of no-fault auto insurance), the probability of occurrence is difficult to estimate but the impact on case filings is easy to describe.

The members of the Advisory Committee were in substantial agreement on the likelihood that the various events would occur. Consensus became less prevalent, however, as the associated time interval was placed further in the future. The substantial degree of consensus reached by the Committee during the exercise is especially significant since the members developed their estimates without the benefit of feedback. They were not given the opportunity to modify their probability estimates after seeing the responses of other members and hearing the rationale for those responses because the Committee's time had to be expended on other exercises. Still, the Committee was in remarkable agreement despite the absence of discussion and re-estimation.

Analysis of the estimates further enhances the value of the exercise. As the estimates moved away from 50 percent (the "equally probable" response) in either direction (i.e., as the Committee

moved away from uncertainty in its estimation), the agreement of the members as to the estimate increased. This is evidence in support of the claim that the members possessed common reasons for concluding that events will or will not occur. As the estimation reached into more distant time periods, the estimates tended toward the center of the response scale (i.e., toward the "equally probable" answer of 50 percent) with less agreement among the experts. This supports a common-sense view that long-range forecasting (to 1995) is more uncertain and fraught with more disagreement than short-range forecasting (to 1979).

The impact of each event on each of the other events was also estimated in the exercise. Most of the events were judged (in pairs) by the Advisory Committee to be independent of each other. Some events, however, were judged to be positively (or negatively) enhanced (or inhibited) by the occurrence of other events.*

The Advisory Committee also provided estimates of impact on each of the 42 case categories given the occurrence of each of the 33 "surprise events." The impact of "surprise events" on case filings will be found in Table Four. (No entry in this Table means that there is no impact of a given "surprise event" on a particular case category.) During the course of this exercise, the members of the Committee struck, as not relevant, 12 case categories from the original list of

* The Committee was of the view that the probability of marked acceleration in inflation was inhibited by the occurrence of economic depression. The estimation exercise took place in April 1974 before conventional economic theory was put to the test by the recent experience of severe economic downturn coupled with soaring inflation.

42 case types. The Committee also added a new category (private right of action) although this is not now specifically identified in Administrative Office codes. Overall, the Committee expects district courts to be more accessible to individuals or groups than in the past.

TABLE FOUR FOLLOWS AT PAGES 25-30

The impact estimates were achieved by first assuming the "surprise-free" case filing volume in each of the case categories to be 100 cases per year. An impact estimate of 100 implied that the event will have no impact on cases filed in a particular category. (These estimates have been deleted from the Table). A response greater than 100 implied that more cases will be filed as a result of the event (e.g., a response of 150 says that the volume in a specific category will increase by 50 percent). Similarly, a response less than 100 implied that fewer cases will be filed as a result of the event (e.g., a response of 80 says that the volume of cases in a particular category will decrease by 20 percent).

This portion of the exercise proved to be most difficult. The members of the Committee varied widely in their opinions, not just

TABLE FOUR. IMPACT OF "SURPRISE EVENTS" ON CASE FILINGS

"SURPRISE EVENTS"	Case Categories: Prisoner Petitions	Civil Rights	Narcotic Addict Rehabilitation Act	Fair Labor Standards Act	Labor Management Relations Act	Social Security Law	Tax Suits	Securities, Commodities & Exchanges	Commerce (ICC rates, etc.)	Antitrust	Food and Drug Act	Motor Vehicle Personal Injury	Marine Personal Injury	Employer's Liability Act	Marine Contract Actions	Negotiable Instruments
Reduction in prison population	60	80	115													
Increases in non-judicial handling of prisoner complaint	38															
Limitations on availability of federal habeas corpus	52															
Further expansion of government tort liability		112														
Relaxation of class action requirements		115						115		110	121					
Increased legal assistance to welfare and low income groups	115	131		108		124					109	105				
Expansion of provisions for attorney fee recovery	108	124								108	112					
Increased decriminalization of drug use	88															
Increased government role in regulating labor conditions				117	124											
No-fault auto insurance												70				
National medical insurance																
Restriction of diversity jurisdiction												64	90			85
Increase of $10,000 requirement in Tucker Act cases																

TABLE FOUR: IMPACT OF "SURPRISE EVENTS" ON CASE FILINGS

(Continued)

Case Categories

"SURPRISE EVENTS"	Insurance Contract Actions	Miller Act	Foreclosures	Immigration Laws	Auto Theft	Transportation of Forged Securities	Counterfeiting	Marijuana Tax Act	Weapons and Firearms	Postal Theft	Theft, Interstate Shipments	Postal Embezzlement	Bank Embezzlement	Income Tax Fraud	Private Right of Action	
Reduction in prison population																
Increases in non-judicial handling of prisoner complaint																
Limitations on availability of federal habeas corpus																
Further expansion of government tort liability																
Relaxation of class action requirements															108	
Increased legal assistance to welfare and low income groups															115	
Expansion of provisions for attorney fee recovery															115	
Increased decriminalization of drug use								30								
Increased government role in regulating labor conditions																
No-fault auto insurance	90															
National medical insurance																
Restriction of diversity jurisdiction	85														73	
Increase of $10,000 requirement in Tucker Act cases																

TABLE FOUR. IMPACT OF "SURPRISE EVENTS" ON CASE FILINGS

(Continued)

Case Categories

"SURPRISE EVENTS"	Prisoner Petitions	Civil Rights	Narcotic Addict Rehabilitation Act	Fair Labor Standards Act	Labor Management Relations Act	Social Security Law	Tax Suits	Securities, Commodities & Exchanges	Commerce (ICC rates, etc.)	Antitrust	Food and Drug Act	Motor Vehicle Personal Injury	Marine Personal Injury	Employer's Liability Act	Marine Contract Actions	Negotiable Instruments
Changed travel patterns due to travel costs (mass transport subsidation)																
Widespread prepaid legal insurance						112					108					
Reduction in the physical transfer of financial paper and negotiable instruments																87
Simplification of federal income tax structure							72									
Economic depression		112		110	109	114										
Marked acceleration in inflation																
Substitution of compensation system for transportation workers													80	90		
Removal of business from appellate courts to district courts																
Introduction of mandatory arbitration		95		85	85						86	86	86	82	86	
Increased regulations on firearms																
Increased consumer protection legislation										112						
Elimination of district court review of land use																
Increased federal regulation of land use																

TABLE FOUR. IMPACT OF "SURPRISE EVENTS" ON CASE FILINGS
(Continued)

"SURPRISE EVENTS"	Case Categories: Insurance Contract Actions	Miller Act	Foreclosures	Immigration Laws	Auto Theft	Transportation of Forged Securities	Counterfeiting	Marijuana Tax Act	Weapons and Firearms	Postal Theft	Theft, Interstate Shipments	Postal Embezzlement	Bank Embezzlement	Income Tax Fraud	Private Right of Action	
Changed travel patterns due to travel costs (mass transport subsidation)																
Widespread prepaid legal insurance															113	
Reduction in the physical transfer of financial paper and negotiable instruments						75	81			65	95	80	92			
Simplification of federal income tax structure														82		
Economic depression			138		111		110		112	112	110	114	110			
Marked acceleration in inflation																
Substitution of compensation system for transportation workers																
Removal of business from appellate courts to district courts																
Introduction of mandatory arbitration	85														90	
Increased regulations on firearms									125							
Increased consumer protection legislation															120	
Elimination of district court review of land use																
Increased federal regulation of land use																

TABLE FOUR. IMPACT OF "SURPRISE EVENTS" ON CASE FILINGS
(Continued)

"SURPRISE EVENTS"	Case Categories: Prisoner Petitions	Civil Rights	Narcotic Addict Rehabilitation Act	Fair Labor Standards Act	Labor Management Relations Act	Social Security Law	Tax Suits	Securities, Commodities & Exchanges	Commerce (ICC rates, etc.)	Antitrust	Food and Drug Act	Motor Vehicle Personal Injury	Marine Personal Injury	Employer's Liability Act	Marine Contract Actions	Negotiable Instruments
Legislation increasing environmental protection																
Increased federal regulations on energy and resources																
Energy resource shortages (cases resulting from an inability to meet contractual obligations)																
Urban development or rural decentralization (federal money as vehicle)												60				
Occurrence of major national hostilities		108										110				
Massive increases in leisure time																
Medical improvements resulting in a much older population						115										

TABLE FOUR. IMPACT OF "SURPRISE EVENTS" ON CASE FILINGS
(Continued)

"SURPRISE EVENTS"	Case Categories: Insurance Contract Actions	Miller Act	Foreclosures	Immigration Laws	Auto Theft	Transportation of Forged Securities	Counterfeiting	Marijuana Tax Act	Weapons and Firearms	Postal Theft	Theft, Interstate Shipments	Postal Embezzlement	Bank Embezzlement	Income Tax Fraud	Private Right of Action	
Legislation increasing environmental protection															113	
Increased federal regulations on energy and resources															114	
Energy resource shortages (case resulting from an inability to meet contractual obligations)	105														110	
Urban development or rural decentralization (federal money as vehicle)																
Occurrence of major national hostilities					85			87								
Massive increases in leisure time																
Medical improvements resulting in a much older population																

in degree, but often in direction. Part of the problem stemmed from how the "surprise events" were defined. Some of the events were not defined as discrete occurrences of the future but rather as an acceleration of existing trends (e.g., increases in non-judicial handling of prisoner complaints, increased decriminalization of drug use, etc.). This introduced an additional variable in the context of estimating impact because the experts perceived different rates of increase (or decrease). Further, the perception of impact depended upon the portion of the court's business most familiar to the individual providing the estimate. Some of the "surprises" will result in shifts in the dominant basis for jurisdiction in affected civil case categories. These shifts were not recognized by all experts; consequently, one expert might see the influence as a decrease in case filings while another expert might see it as an increase.

Predicting the Past

In order to evaluate the reliability of the forecasts and the models from which the forecasts are derived, case filing volumes were "forecasted" for 1968 and 1970 using models developed from data in time periods prior to 1966. The forecasted values were compared with the actual values for those two years. Of course, the case filing forecasts generated by the models are subject to error. Therefore, case filing forecasts have upper and lower limits (or

bounds) in order to account for error. This technique of fitting bounds to the forecasts permits a level of confidence in the estimates such that 19 times out of 20 the actual case filing volume will fall within the bounds of the forecast. For the most part, the observed values fell within the bounds on the forecasts. In three categories, however, the observed values were well outside these bounds. In each of these categories (civil rights cases, Selective Service Act cases, and private fraud cases) there was a rapid increase in case filing volume in the 1966-1970 period. These rapid increases can be associated with the occurrence of "surprise events":

civil rights cases -- a progression of civil rights legislation and judicial decisions across the 1964-1968 period.

selective service cases -- increasing opposition to American military involvement in Indochina.

private fraud cases -- federal legislation (Truth-In-Lending Act, Consumer Credit Protection Act) and increased citizen awareness of consumer protection.

The difficulty encountered in forecasting estimates in these three case categories clearly demonstrates the need to anticipate "surprise events" in forecasting the level of district court business and further demonstrates the inadequacies of other extrapolative methods.

Results of the Forecasting Study

The results of this forecasting effort are most encouraging in that our ability to explain past variations in case filing volumes over time seems to have been much improved by the indicator-based models. It appears that the social, political, economic and demographic variables that premised our study can be used effectively in forecasting case filing volumes; we have found that certain indicators (one or a combination of them) are highly correlated with certain case types. For example, the average sentences of federal prisoners is strongly correlated with the number of escape cases. And, the budget of HEW, median months to trial in civil cases and the number of bar members (estimated from census data) are strongly correlated with Food and Drug Act cases. Similar correlations have been generated for each of the 42 cases types in the study. Furthermore, the projections make more sense intuitively than do forecasts based upon previous models; the indicator-based models are believable and logical.

The Appendix, which follows at page A1, contains a few examples of the type of information generated in our forecasting effort. In all, 4200 sets of forecasts were developed and compiled in the report delivered by Battelle. The examples were selected because they illustrate both the strengths and the weaknesses of the models, and were chosen to demonstrate the modelling effort at the national, circuit and district court levels. The first few examples are relatively

simple; the others increase in complexity as the Appendix unfolds. The examples are also designed to reflect the different mix of indicators that can come into play in the same case category for different district courts and for different levels of aggregation.

When the appropriate statistical conditions exist, two types of models (mathematical summaries) are displayed in each of the case type forecasts: the autoregressive model and the indicator-based model.

For the autoregressive models, the case filing volume in a particular year [expressed symbolically as Y(T)] is described in terms of previous filings in that case type. The immediately preceding case filing experience is expressed as Y(T-1). The case filing experience from two year's ago is expressed as Y(T-2), and so forth. For the indicator-based models, the case filing volume in a given year [expressed symbolically as Y(T)] is described in terms of indicators expressed as X(1.T-0) for the first indicator, X(2.T-0) for the second indicator, and so forth. Each of the indicators may be lagged up to three years on the theory that a change in an indicator value will transmit an advanced signal for case filing change. Thus, for each indicator, there may be no lag (expressed as T-0), a one-year lag (expressed as T-1), a two-year lag (expressed as T-2), or a three-year lag (expressed as T-3).

On the graphs* that follow in the Appendix, the autoregressive models are displayed by a dashed line and the indicator-based models

*Graphs have been provided for the national and circuit level forecasts only.

by a solid line. The ★ symbols on the graph depict the trend in filings over the years. Another aspect of this comparison is the "percent variability explained", a measure of the accuracy of the model. The higher this percentage, the more accurately the model explains the past, and, hence, the more confident we should be in relying on it to forecast the future.

Caseload values have been projected for 1979, 1984 and 1995. The surprise-free forecasts reflect an extension of the autoregressive models and the indicator-based models into the future. These forecasts are premised on the view that the experience of the past will continue without change into the future. The surprise forecasts reflect the opinions of the Advisory Committee. Their probability estimates of the occurrence of the 33 "surprise events" have been combined with the estimated impact of those events, should they occur, on the case filing volumes. These estimates have been incorporated into the autoregressive and indicator-based models.

Some Cautionary Notes

While the results highlighted above demonstrate the superiority of the indicator-based models, certain limitations imposed during the development of the models inhibit all the comparisons from autoregressive to indicator-based models. The case filing data used in the indicator-based models have been subjected to a filtering

process that removes year-to-year perturbations but leaves the structure of case filings intact. The filtering was accomplished by use of a three-year moving median analysis in which the case filing volume for a given year was replaced by the median (middle value) of the volume for the year in question and the filing volumes of the years on either side of it. The objective of this step was the development of forecasts and models that reflect the structure of caseload change across time but are not distorted by short-term perturbations.

The autoregressive models were developed using the actual caseload data without smoothing the data through the median filtering process. The smoothing process was not undertaken because of a theoretical statistical concern that there would be no way to attach bounds to the autoregressive forecasts if the case filing volume across time is disturbed in an unknown and unanalyzable way. A decision was made to generate forecasts with bounds. Therefore, in order to retain bounds on the autoregressive models, the actual caseload values had to be used.

Both types of models have bounds attached to them, but the data upon which they are based are not strictly comparable. Therefore, it is not appropriate to use "percent variability explained" as the single yardstick to compare the two models since the caseload data used are not exactly the same.

In reviewing the forecast examples in the Appendix, the reader will observe that autoregressive models have not been developed for many of the criminal case categories. This occurred when there was insufficient data across time to develop a model. The statistical theory upon which the autoregressive models were based requires at least 50 or, more often, 100 observations in order to develop a model. This requirement had to be ignored for parts of this effort, but the bottom line was drawn when there was less than 12 years of caseload data available.

Lack of many observations across time did not prevent development of the indicator-based models, but it did limit their development when the number of years of data was very small. In order to summarize data (i.e., to develop a model), there must be fewer independent terms in the model than there are observations. Thus, if there are three years of data, there must be fewer than three independent terms in the model. This rule was further constrained by the effort to develop bounds on the models. The development of bounds requires the use of observations that have not been consumed in the development of the model itself. The bounds were computed at the 95 percent level, i.e., 19 times out of 20 the actual caseload will lie within the upper and lower limits of the predicted caseload. Thus, bounds based on fewer observations will be wider than bounds based on a larger number of observations. The wider the bounds, the less precise the forecast.

Occasionally, an autoregressive model has been developed but no predictions are generated because a necessary statistical requirement has not been met. If a time-series has been labeled as "non-stationary," then it is not possible, given the approach used in the forecasting effort, to generate a prediction. Usually non-stationariness occurs when there is a dramatic and repeated increase in case filing volume at the end of the time-series in relation to an earlier pattern of stability. Stationariness is only a requirement for the autoregressive models; its absence does not affect the indicator-based models.

A last point to consider is the size of the task involved; the management of the data collection and processing effort was Herculean. Forty-two hundred sets of different forecasts have been developed; in a substantial number there are autoregressive and indicator-based models. The statistical procedures used in this effort provide a computationally convenient way to manage this flood of information. If each of the indicators were independent of the others (i.e., if a change in one indicator value was not correlated with a change in any other indicator), then we could interpret the contribution of each of the indicator variables with relative ease. But the indicator variables are highly correlated across time. Thus, while the statistical procedures maximize the power of the model (i.e., explain the most variability), the procedures do not permit the replacement of one indicator with another that would make more intuitive sense in the identification of driving forces behind the litigation

in that case type. For example, Labor Management Relations Act cases are almost perfectly correlated with the growth in population for persons 18-64. Had the National Labor Relations Board budget been used as the indicator (because it was more intuitively appealing than population data), it would have done nearly as good a job in explaining the variability of this case type over time. In short, the lack of intuitive satisfaction with the selected indicators in a given case type does not mean that such a connection is not obtainable; it is just not possible, in the absence of more information about the indicators, to infer from the models themselves the forces that generate litigation. Still, in many of the indicator-based models, the selected indicators are intuitively satisfying; the indicators can reasonably be related to the particular case type.

Conclusion

The Center's forecasting work demonstrates that indicator-based forecasts can and should be used in order to provide guidance in planning the allocation of resources in the district courts. These forecasts improve upon past efforts at projections, in part because they are intuitively satisfying; many of the developed relationships square with common sense. In addition, the "surprise-free" forecast values reflect the assumption that things will remain the same and the "surprise" forecast values reflect the assumption that the future

will not be like the past. This affords the ability to modify projections based on a reasonable view of the future and, thus, significantly enhances the acceptability of the forecasts. Of course, nothing but experience will confirm that these forecasts are accurate, but, short of that the alternatives are either (1) to plan on the basis of demonstrated need and always lag behind in the effort to match resources to the present demand or (2) to plan on the basis of estimated future values subject to whatever modifications actual experience requires.

The Center is continuing its forecasting efforts with the goal of enhancing the acceptability and usefulness of the techniques described in this study. This initial effort has raised many questions, but, we are confident that additional research can resolve many of them. The point to be stressed, however, is not that there are achievable refinements in forecasts founded upon indicator-based models, but rather that this method of predicting case filings marks a significant advance over previous efforts. The work of the Federal Judicial Center in this project leads quite reasonably to this conclusion.

Example 1: Escape Cases -- National Models

This first example is representative of many of the criminal case-type models developed at the national level. Too few years of case filing data prevented the development of an autoregressive model. The indicator-based model has nearly perfect fit to the number of defendants charged with excape across the time period as indicated by the 99 percent variability explained by the model.

The indicators do not seem to be spurious; indeed, it is easy to rationalize the correlation in "Average Months of Sentence" to this category. Further speculation about the driving forces that generate excape cases is not possible without more information about the relationship between the two indicators in the model and others that were candidates for model development.

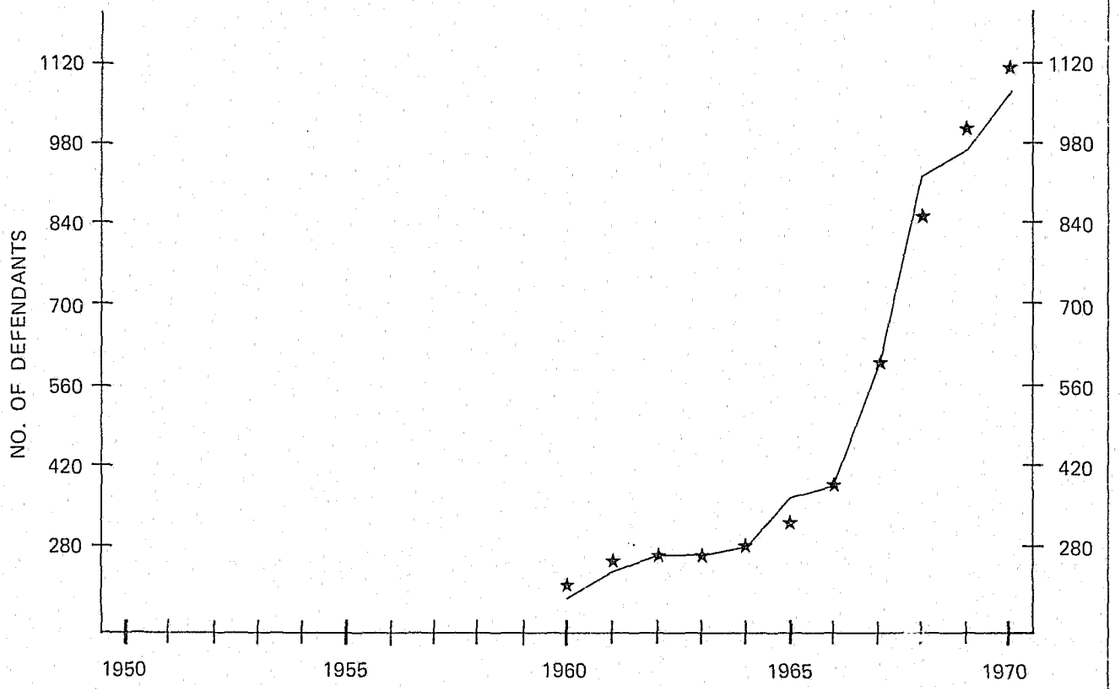
The "surprise events" will not impact on this category as indicated by the same values under the "Predicted Cases" columns for both the "Surprise-Free" and the "With Surpises" forecasts. The upper and lower limits provide a range within which we expect the actual values in 1979, 1984 and 1995 to fall. Thus, by 1995 we expect the number of defendants charged with escape to grow to about 2710 with the range falling between 2504 and 2916.

U. S.

ESCAPE (U.S.)

YEARS OF DATA AVAILABLE
1960-1970

MEAN NO. OF DEFENDANTS
502.



INDICATOR-BASED MODEL 99 PERCENT VARIABILITY EXPLAINED

B. $Y(T) = 1933.5 + 33.3 \times (1.T-0) + 539 \times (2.T-0)$

X (1.T–0) = AMERICAN BAR ASSOCIATION MEMBERSHIP
X (2.T–0) = AVERAGE MONTHS OF SENTENCE OF FEDERAL PRISONERS

FORECASTS

	YEAR	SURPRISE-FREE PREDICTED CASES	SURPRISE-FREE LIMITS LOWER	SURPRISE-FREE LIMITS UPPER	WITH SURPRISES PREDICTED CASES
AUTOREGRESSIVE MODEL	1979	TOO FEW YEARS OF DATA AVAILABLE FOR TIME SERIES ANALYSIS			
	1984				
	1995				
INDICATOR-BASED MODEL	1979	1569.	1434.	1704.	1569.
	1984	1931.	1771.	2090.	1931.
	1995	2710.	2504.	2916.	2710.

Example 2: Social Security Cases -- Circuit A Models

The information presented in this example is typical for this case type at the circuit level. District court filings were aggregated by circuit in order to provide the data upon which models were developed. Too few years of case filing data again prevented the construction of an autoregressive model. The indicator-based model is nearly perfect in its ability to explain variations in case filing volume over time. This is based on the 99 percent variability explained by the model across the six-year period for which case filing data are available. The selected indicators are also intuitively appealing in terms of identifying driving forces behind this type of litigation.

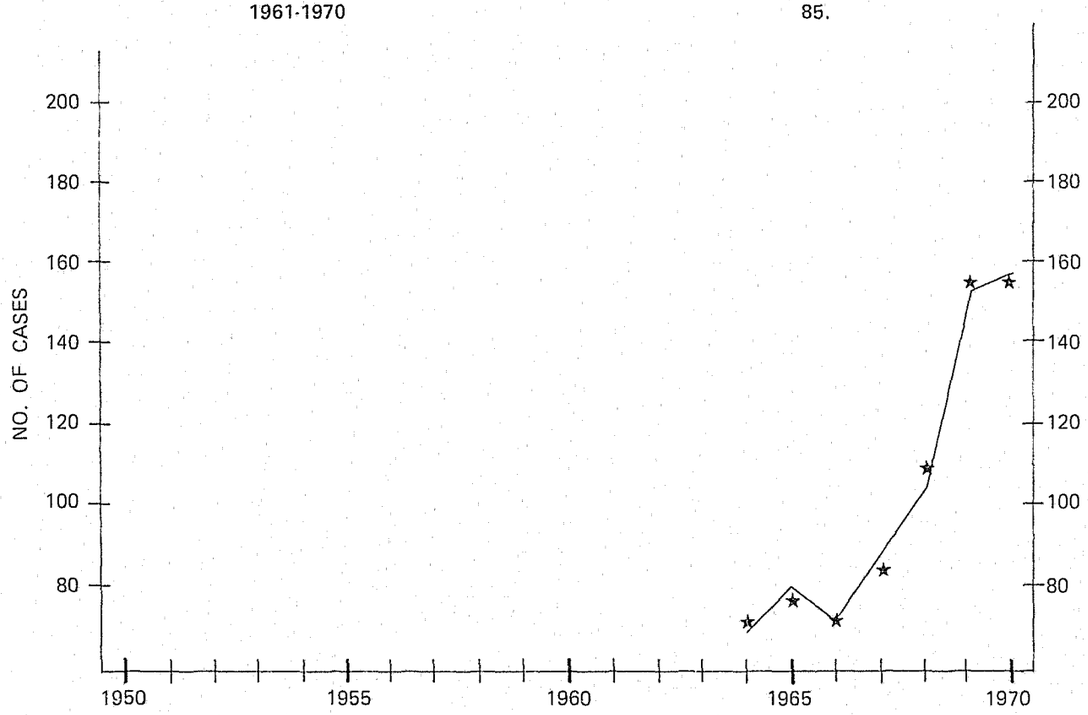
The "surprise-free" forecasts indicate an increasing number of social security cases in the future, rising from a level of 400 in 1979 to 714 in 1995. This increase in exacerbated by the estimated impact of the "surprise" events, bring the number of cases to a level of 529 in 1979 with further increase to 978 cases by 1995.

CIRCUIT A

SOCIAL SECURITY LAWS (U.S.)

YEARS OF DATA AVAILABLE
1961-1970

MEAN NO. OF CASES
85.



INDICATOR-BASED MODEL 99 PERCENT VARIABILITY EXPLAINED

B. Y(T) = – 621.90 + 1.53 X (1.T–3) + 36.7 X (2.T–1) + 15.1 X (3.T–3)

X(1.T-3) = CLAIMS FILED WITH SOCIAL SECURITY ADMINISTRATION
X(2.T-1) = PEOPLE UNDER AGE 65 PROTECTED BY REGULAR MEDICAL EXPENSE
X(3.T-3) = UNEMPLOYMENT RATES

FORECASTS

	YEAR	SURPRISE-FREE PREDICTED CASES	LIMITS LOWER	LIMITS UPPER	WITH SURPRISES PREDICTED CASES
AUTOREGRESSIVE MODEL	1979	TOO FEW YEARS OF DATA AVAILABLE FOR TIME SERIES ANALYSIS			
	1984				
	1995				
INDICATOR-BASED MODEL	1979	400.	307.	494.	529.
	1984	502.	381.	622.	682.
	1995	714.	527.	901.	978.

Example 3: Miller Act Cases (Private) -- District X Models

This example presents the forecast developed for the smallest unit within the federal judiciary, the district court. Graphs were not prepared for this level of forecasting.

The autoregressive model at this level has poor fit to the case filing volume across the 1950-1970 time period. This is determined by the low percent of variability explained by the model (in this case, it is 32 out of a possible 100 percent). The indicator-based model has good fit to its case filing data, explaining 85 percent of the variability in filings over time.

Six indicators were used in the indicator-based model. It may be possible to rationalize why some or even all of the indicators appeared in this model, but without further information about the indicators and their relationships to each other over time, it is very difficult to engage in anything beyond speculation concerning driving forces behind this case type.

The surprise events will not impact on this category, and the view of the future in both models is for a fairly constant case filing volume. The autoregressive model predicts that case filings will probably lie between 0 and 34 for each of the three forecast years. The indicator-based model predicts a range from 9 to 30 cases for 1979, 6 to 34 cases for 1984, and 0 to 41 cases for 1995. The confidence in the predicted range remains fixed at the 95 percent level, but the range itself widens for more distant predictions in order to accommodate greater uncertainty in the estimates of indicator values.

MILLER ACT (PRIVATE) DISTRICT X

YEARS OF DATA AVAILABLE	MEAN NO. OF CASES
1950-1970	16

AUTOREGRESSIVE MODEL 32 PERCENT VARIABILITY EXPLAINED

A. $Y(T) = 8.3377 + .515Y(T-1)$

INDICATOR BASED MODEL 85 PERCENT VARIABILITY EXPLAINED

B. $Y(T) = -21.642 - .337 \times (1.T-0) - 1.55 \times (2.T-0) - 3.59 \times (3.T-3) + 5.30 \times (4.T-0) + 4.86 \times (5.T-3) - .178 \times (6.T-0)$

X (1.T–0) = STOCKS TRADED ON ALL STOCK EXCHANGES

X (2.T–0) = STANDARD AND POOR'S 500 COMPOSITE STOCK INDEX

X (3.T–3) = MEDIAN MONTHS TO TRIAL IN CIVIL CASES

X (4.T–0) = BAR MEMBERS (ESTIMATED)

X (5.T–3) = DOLLAR VALUE OF NEW FEDERAL GOVERNMENT CONSTRUCTION

X (6.T–0) = CASES FILED IN U.S. COURT OF CLAIMS

FORECASTS

		SURPRISE-FREE			WITH SURPRISES
	YEAR	PREDICTED CASES	LIMITS LOWER	LIMITS UPPER	PREDICTED CASES
AUTOREGRESSIVE MODEL	* 1979	17.	0.	34.	17.
	** 1984	17.	0.	34.	17.
	* 1995	17.	0.	34.	17.
INDICATOR-BASED MODEL	* 1979	19.	9.	30.	19.
	** 1984	20.	6.	34.	20.
	* 1995	19.	0.	41.	19.

Example 4: Marine Personal Injury Cases (Private) -- National Models

The next four examples present information on one case type as developed for each of the three levels, with an additional district forecast provided to show how the data may vary among districts. In the national forecast, the autoregressive model has fairly good fit to the case filing volume of marine personal injury cases, explaining 91 percent of the variability over the period 1953-1970. The indicator-based model also does a good job explaining variability in case filing volume; it explains 96 percent of the variability over the same time period.

The indicator-based model provides some intuitive satisfaction since the indicators can be rationalized to the case category. But there may have been other candidates for model development that would have done nearly as well in explaining variability but because of the procedures used to generate the model, they were not used. In short, the search for driving forces is elusive.

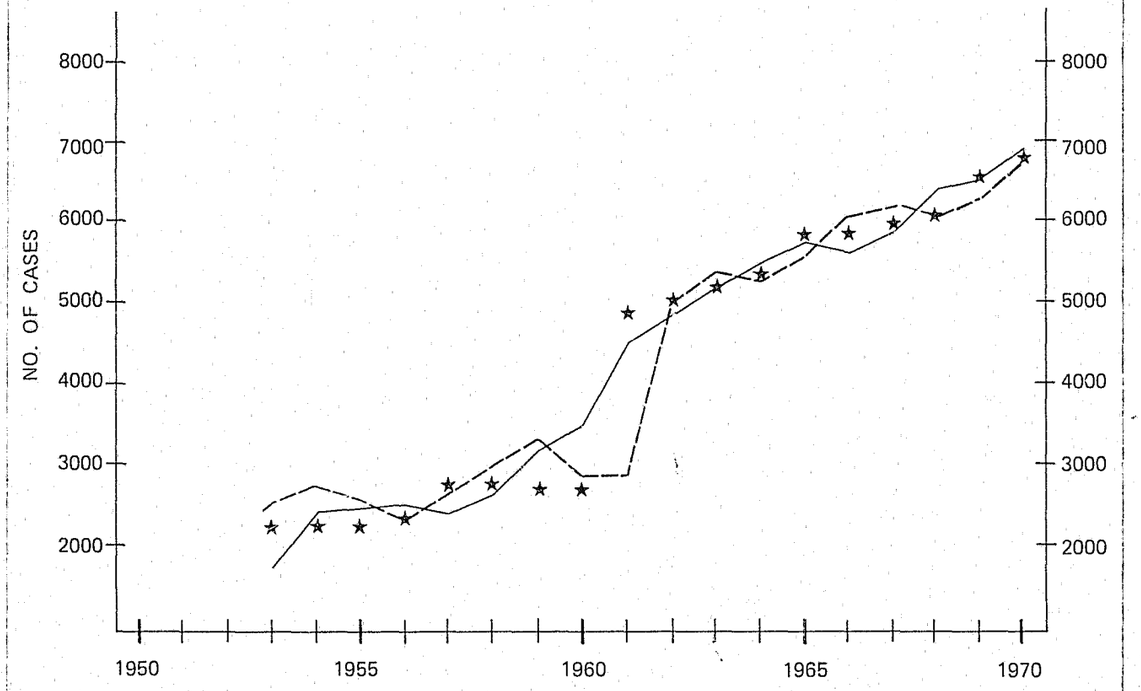
Under the "surprise-free" assumption, the autoregressive model points to a substantial increase in the number of marine personal injury cases by 1995 while the indicator-based model indicates a modest increase by that time. Under the "surprise events" assumptions, the autoregressive model calls for case filing volumes to hover around the 1970 level through the 1980's with a substantial increase by 1995. The indicator-based model, under the "surprise events" assumptions, shows a decline from the 1970 case filing level, with an increase in filings back up to the 1970 level by 1995.

U. S.

MARINE PERSONAL INJURY (PRIVATE)

YEARS OF DATA AVAILABLE
1953-1970

MEAN NO. OF CASES
3971.



AUTOREGRESSIVE MODEL 91 PERCENT VARIABILITY EXPLAINED

A. Y(T) = 333.40 + 0.98Y (T–1)

INDICATOR-BASED MODEL 96 PERCENT VARIABILITY EXPLAINED

B. Y(T) = –2916.2 + 3764 X (1.T–3) –1310 X (2.T–0)

X (1.T–3) = BAR MEMBERS (ESTIMATED)

X (2.T–0) = PERCENT OF ILLNESSES REPORTED (BASED ON ANNUAL AVERAGE SEAFARING JOBS)

FORECASTS

	YEAR	SURPRISE-FREE PREDICTED CASES	SURPRISE-FREE LIMITS LOWER	SURPRISE-FREE LIMITS UPPER	WITH SURPRISES PREDICTED CASES
AUTOREGRESSIVE MODEL	1979	8312.	5255.	11368.	6899.
	1984	9077.	5446.	12709.	6990.
	1995	10502.	6113.	14892.	8297.
INDICATOR-BASED MODEL	1979	7479.	6658.	8300.	6208.
	1984	7954.	7108.	8800.	6125.
	1995	8663.	7775.	9552.	6844.

Example 5: Marine Personal Injury Cases (Private) -- Circuit B Models

The autoregressive model for this circuit is fairly strong, explaining 87 percent of the variability in case filing volume over the 21-year period, 1950--1970. The indicator-based model has a stronger fit to its case filing volume, explaining 94 percent of the variability in case filing activity across that time period.

The "surprise-free" and the "surprise" forecasts for the autoregressive model show increases over time, with slightly less volume under the "surprise" assumptions. Both the "surprise-free" and the "surprise" forecasts for the indicator-based model show modest increases in 1979 and 1984 with more substantial increase in 1995. Overall, the indicator-based model under either assumption predicts more cases of this type than the autoregressive model.

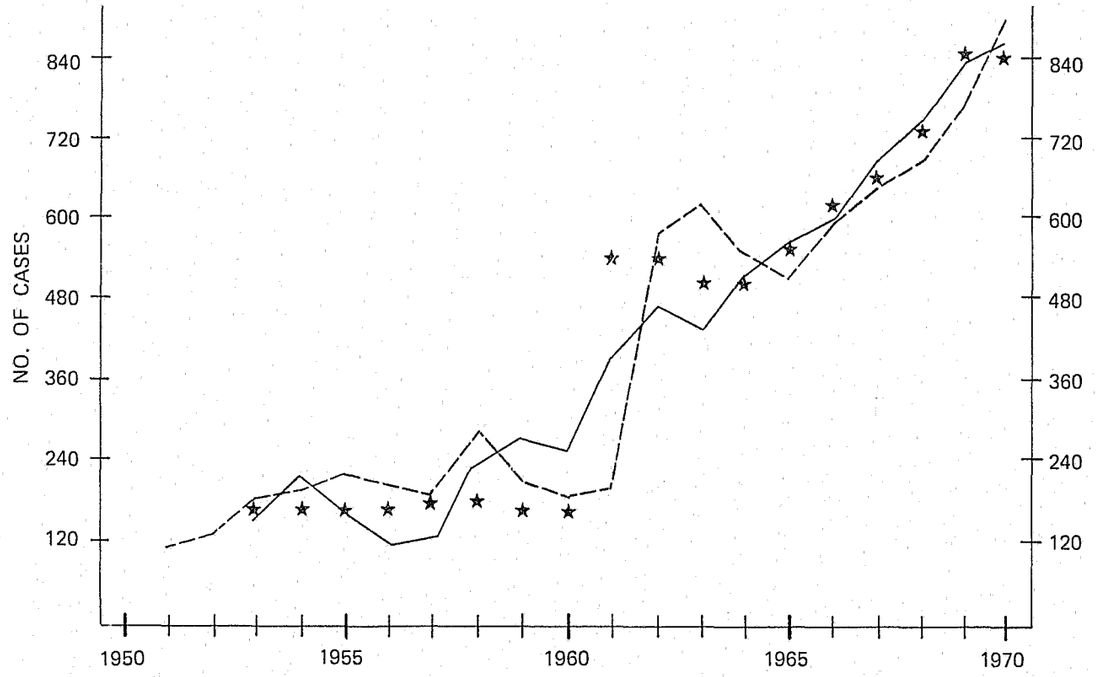
The bounds on the forecasts (i.e., the upper and lower limits within which the actual filing volume is expected to fall) are fairly wide for both models, although the indicator-based bounds are somewhat narrower. This narrower bounding indicates greater precision in forecasting case volume. Of the two models, the indicator-based in probably superior.

CIRCUIT B

MARINE PERSONAL INJURY (PRIVATE)

YEARS OF DATA AVAILABLE
1950-1970

MEAN NO. OF CASES
380.



AUTOREGRESSIVE MODEL 87 PERCENT VARIABILITY EXPLAINED

A. $Y(T) = 45.555 + 0.98Y(T-1)$

INDICATOR-BASED MODEL 94 PERCENT VARIABILITY EXPLAINED

B. $Y(T) = -607.43 + 11.1 X(1.T-2) + 196 X(2.T-0) + 100 X(3.T-3)$

X (1.T–2) = MARITIME ADMINISTRATION BUDGET
X (2.T–0) = COAST GUARD PERSONNEL ON ACTIVE DUTY
X (3.T–3) = DOLLAR VALUE OF IMPORTS

FORECASTS

	YEAR	SURPRISE-FREE PREDICTED CASES	SURPRISE-FREE LIMITS LOWER	SURPRISE-FREE LIMITS UPPER	WITH SURPRISES PREDICTED CASES
AUTOREGRESSIVE MODEL	1979	1109.	503.	1654.	920.
	1984	1223.	573.	1873.	942.
	1995	1438.	648.	2228.	1156.
INDICATOR-BASED MODEL	1979	1339.	973.	1704.	1111.
	1984	1544.	1057.	2030.	1189.
	1995	1986.	1217.	2756.	1569.

Example 6: Marine Personal Injury Cases (Private) -- District R Models

In the first district, the autoregressive model has modest fit to the case filing volume over time, explaining 59 percent of the variability. The indicator-based model has much greater fit to its case filing volume, explaining 96 percent of the variability across time.

Six indicators were used to generate the indicator-based model. Many of these indicators can be rationalized with the case category, but precise statements about cause and effect and the sources of marine personal injury litigation in federal courts cannot be inferred from the model alone.

The predictions for the autoregressive model show some fluctuation over time under the "surprise-free" assumption. The "surprise" assumptions reduce the forecasted values modestly. The indicator-based model points to a much larger volume of marine personal injury cases in this district, with increases over the next 20 years. The forecasts modified by the "surprise events" indicate a modest reduction from the "surprise-free" levels. The bounds on the indicator-based model are narrower than the bounds on the autoregressive model. This is another indication of the precision of the indicator-based model in relation to the autoregressive model.

MARINE PERSONAL INJURY (PRIVATE) DISTRICT R

YEARS OF DATA AVAILABLE	MEAN NO. OF CASES
1950-1970	12

AUTOREGRESSIVE MODEL 59 PERCENT VARIABILITY EXPLAINED

A. Y(T) = 4.9678 + .640 Y(T–1) – .153 Y (T–2) + .670 Y (T–3) – .488 Y (T–4)

INDICATOR-BASED MODEL 96 PERCENT VARIABILITY EXPLAINED

B. Y(1) = 21.819 + 9.65 X (1.T–0) – 13.1 X (2.T–2) – 4.90 X (3.T–0)
+ 10.4 X (4.T–3) – 17.3 X (5.T–1) + 10.1 X (6.T–1)

X (1.T–0) = COAST GUARD PERSONNEL ON ACTIVE DUTY

X (2.T–2) = MEDIAN MONTHS TO TRIAL IN CIVIL CASES

X (3.T–0) = DOLLAR VALUE OF IMPORTS

X (4.T–3) = BAR MEMBERS (ESTIMATED)

X (5.T–1) = PERCENT OF ILLNESSES REPORTED (BASED ON ANNUAL AVERAGE SEAFARING JOBS)

X (6.T–1) = PERCENT OF INJURIES REPORTED (BASED ON ANNUAL AVERAGE SEAFARING JOBS)

FORECASTS

		SURPRISE-FREE			WITH SURPRISES
	YEAR	PREDICTED CASES	LIMITS LOWER	UPPER	PREDICTED CASES
AUTOREGRESSIVE MODEL	* 1979	11.	0.	45.	10.
	** 1984	17.	0.	50.	13.
	* 1995	15.	0.	49.	12.
INDICATOR-BASED MODEL	* 1979	46.	37.	54.	38.
	** 1984	55.	46.	64.	42.
	* 1995	64.	51.	76.	50.

Example 7: Marine Personal Injury Cases (Private) -- District M Models

For this second district example, the autogressive model cannot yield viable forecasts because the time-series upon which it is based is non-stationary.

The indicator-based model explains 94 percent of the variability in this case type over time. Of note is the fact that one of the indicators is new to this case type when compared to the two preceding models. Differences in indicator combinations from one court to another reflect differences in case filing activity from one court to the next. The models were developed in a fashion that permits these differences over time to be reflected in the indicators used in the model. Again, it is easy to rationalize the use of some of the indicators, but precise statements about the driving forces of litigation cannot be inferred from the models alone.

The "surprise-free" forecast points to substantial increases in this case type. Under the "surprise" assumption, the case volume should be lower but with some increase by 1995.

MARINE PERSONAL INJURY (PRIVATE) DISTRICT M

YEARS OF DATA AVAILABLE: 1950-1970

MEAN NO. OF CASES: 114

AUTOREGRESSIVE MODEL — 98 PERCENT VARIABILITY EXPLAINED

A. $Y(T) = 9.8453 + 1.12Y(T-1) + .818Y(T-2) - 1.10Y(T-3)$

INDICATOR-BASED MODEL — 94 PERCENT VARIABILITY EXPLAINED

B. $Y(T) = -63.469 - 5.45 \times (1.T-0) - 66.8X(2.T-2)$

X (1.T–0) = MEDIAN MONTHS TO TRIAL IN CIVIL CASES

X (2.T–2) = WATERBORNE EXPORTS, CARGO TONNAGE

FORECASTS

		SURPRISE-FREE			WITH SURPRISES
	YEAR	PREDICTED CASES	LIMITS LOWER	LIMITS UPPER	PREDICTED CASES
AUTOREGRESSIVE MODEL	* 1979				
	** 1984	TIME SERIES IS NON STATIONARY.			
	* 1995	PREDICTIONS AND LIMITS ARE INVALID.			
INDICATOR-BASED MODEL	* 1979	513.	423.	603.	426.
	** 1984	620.	521.	720.	478.
	* 1995	856.	732.	980.	676.

Example 8: Prisoner Petitions (Private) -- District Z Models

This final example illustrates the forecast for a case type of particular interest to many judges.

The autoregressive model in this case category has reasonably good fit to the number of private prisoner petitions over time. The model explains 86 percent of the variability over time. Although the model is fairly strong, the autoregressive techniques cannot be used to predict case volume in the future because certain statistical assumptions needed for forecasting have not been met. The failure to satisfy these assumptions is noted by the designation of the time-series as non-stationary.

The indicator-based model has strong fit to its case filing volume, explaining 95 percent of the variability across time. The two indicators are not unreasonable signals for change in this case category, but without additional information, it would be difficult to infer anything about forces generating prisoner litigation.

The "surprise-free" forecasts call for an increase in the number of prisoner petitions in the future, but the "surprise event" forecasts point to a substantial decline.

PRISONER PETITIONS (PRIVATE) DISTRICT Z

YEARS OF DATA AVAILABLE	MEAN NO. OF CASES
1955-1970	24

AUTOREGRESSIVE MODEL 86 PERCENT VARIABILITY EXPLAINED

A. Y(1) = 5.8023 + .877 Y (T–1) –.340 Y (T–2) + 1.13 Y (T–3)

INDICATOR-BASED MODEL 95 PERCENT VARIABILITY EXPLAINED

B. Y(T) = –72.297 – 1.00 X (1.T–3) + 11.1 X (2.T–1)

X (1.T–3) = AMERICAN BAR ASSOCIATION MEMBERSHIP

X (2.T–1) = DIRECT PER CAPITA EXPENDITURES BY STATE FOR EDUCATION

FORECASTS

		SURPRISE-FREE			WITH SURPRISES
	YEAR	PREDICTED CASES	LIMITS LOWER	UPPER	PREDICTED CASES
AUTOREGRESSIVE MODEL	* 1979				
	** 1984 TIME SERIES IS NON STATIONARY.				
	* 1995 PREDICTIONS AND LIMITS ARE INVALID.				
INDICATOR-BASED MODEL	* 1979	127.	98.	155.	54.
	** 1984	156.	122.	190.	61.
	* 1995	221.	175.	268.	62.

GPO 897-576

END