

# Regression Based Service Rate Estimation

September 8, 2021

## 1 Overview

This week I worked on extending the regression model for service rate estimation to account for idleness. The main problem that we are trying to tackle is that the simple model,  $\text{Days}_j = \beta_t \text{Trial}_j + \beta_p \text{Plea}_j + \epsilon_j$ , doesn't account for idling judges. Hester's qualitative interviews with the judges indicates that harsher judges idle more often than more lenient judges. An overview of the results are below.

- **Iterative Idleness Estimation Using Expected Utilization:** This yields estimates of 3 days per trial, and about 14 pleas per day.
- **Iterative Idleness Estimation Taking Mins:** This yields estimates of 6.2 days per trial and 9.7 pleas per day.
- **Fixed Effects Model:** This yields estimates of 3.7 days per trial, and 10 pleas per day.

Table 1: Summary of Results

Model	Group	Pleas per Day	Days per Trial
Min	County	6.92	4.41
Min	Judge	9.66	6.28
Min	Judge-County	14.97	4.25
Utilization	County	7.56	3.25
Utilization	Judge	13.99	3.12
Utilization	Judge-County	20.90	1.73
Fixed Effects	Judge	9.52	3.86
Fixed Effects	Judge-County	10.1	3.71

## 2 Iterative Idleness Estimation Using Expected Utilization

**Step 0:** We estimate the model,  $\text{Days}_j = \beta_t \text{Trial}_j + \beta_p \text{Plea}_j + \epsilon_j$ .

**Steps 1-n:** We then use the estimates of  $\beta_t^{(1)}$  and  $\beta_p^{(1)}$  to estimate the expected number of days it would take each judge to complete their work. Mathematically:  $\text{Expected Days}_j^{(1)} = \beta_p^{(1)} \cdot \text{Plea}_j + \beta_t^{(1)} \cdot \text{Trial}_j$ . Then, the utilization for each judge would be:  $\text{Utilization}_j^{(1)} = \frac{\text{Expected Days}_j^{(1)}}{\text{Days}_j}$ . Let

$\gamma^1 = \max_j \text{Utilization}_j^{(1)}$ , be the maximum utilization amongst all judges. Each judges idleness will be:  $\text{Idleness}_j^{(1)} = \frac{\text{Utilization}_j^{(1)}}{\gamma^{(1)}}$ . We then set  $\text{Days}_j^{(1)} = \text{Days}_j \cdot \text{Idleness}_j^{(1)}$ . We then estimate the model  $\text{Days}_j^{(1)} = \beta_t \text{Trial}_j + \beta_p \text{Plea}_j + \epsilon_j$  and repeat until convergence.

## 2.1 Judge Model

Table 2: Judge Model

<b>Dep. Variable:</b>	y	<b>R-squared (uncentered):</b>	1.000
<b>Model:</b>	OLS	<b>Adj. R-squared (uncentered):</b>	1.000
<b>Method:</b>	Least Squares	<b>F-statistic:</b>	4.033e+32
<b>Date:</b>	Wed, 08 Sep 2021	<b>Prob (F-statistic):</b>	0.00
<b>Time:</b>	12:00:21	<b>Log-Likelihood:</b>	1541.8
<b>No. Observations:</b>	50	<b>AIC:</b>	-3080.
<b>Df Residuals:</b>	48	<b>BIC:</b>	-3076.
<b>Df Model:</b>	2		

	coef	std err	t	P>  t	[0.025	0.975]
<b>Plea</b>	0.0715	5.92e-18	1.21e+16	0.000	0.071	0.071
<b>Trial</b>	3.1154	3.49e-16	8.94e+15	0.000	3.115	3.115

<b>Omnibus:</b>	29.779	<b>Durbin-Watson:</b>	0.611
<b>Prob(Omnibus):</b>	0.000	<b>Jarque-Bera (JB):</b>	60.328
<b>Skew:</b>	-1.784	<b>Prob(JB):</b>	7.94e-14
<b>Kurtosis:</b>	7.027	<b>Cond. No.</b>	85.5

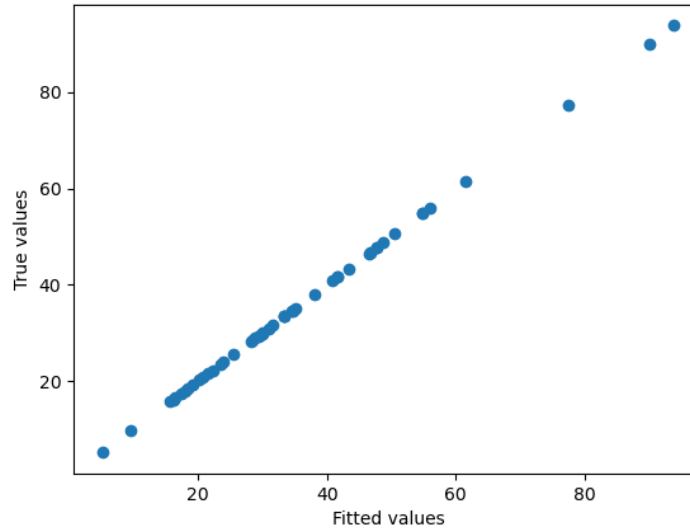


Figure 1: True vs Fitted Values, Judge Model

Table 3: Judge Model

Iteration	Beta P	Beta T
0	0.15	6.48
1	0.07	3.12
2	0.07	3.12

Table 4: Utilization at convergence, judge model

JudgeID	Plea	Trial	Days	TrialDays	PleaDays	Utilization	Idleness
Judge 16	1041	5	90.00	15.58	74.42	1.00	1.00
Judge 24	341	17	110.50	52.96	24.38	0.70	0.70
Judge 42	283	3	44.00	9.35	20.23	0.67	0.67
Judge 46	443	0	48.67	0.00	31.67	0.65	0.65
Judge 5	492	4	76.00	12.46	35.17	0.63	0.63
Judge 6	505	6	89.00	18.69	36.10	0.62	0.62
Judge 39	389	6	76.00	18.69	27.81	0.61	0.61
Judge 40	112	5	40.00	15.58	8.01	0.59	0.59
Judge 7	572	17	167.00	52.96	40.89	0.56	0.56
Judge 11	244	12	107.00	37.38	17.44	0.51	0.51
Judge 33	479	4	98.00	12.46	34.24	0.48	0.48
Judge 50	469	9	129.50	28.04	33.53	0.48	0.48
Judge 22	480	4	98.50	12.46	34.32	0.47	0.47
Judge 38	247	4	64.00	12.46	17.66	0.47	0.47
Judge 25	527	1	87.00	3.12	37.68	0.47	0.47
Judge 10	315	9	108.50	28.04	22.52	0.47	0.47
Judge 26	450	5	103.00	15.58	32.17	0.46	0.46
Judge 2	390	9	121.00	28.04	27.88	0.46	0.46
Judge 44	395	2	78.00	6.23	28.24	0.44	0.44
Judge 47	388	5	100.00	15.58	27.74	0.43	0.43
Judge 30	147	10	96.50	31.15	10.51	0.43	0.43
Judge 8	215	5	72.00	15.58	15.37	0.43	0.43
Judge 17	288	3	73.00	9.35	20.59	0.41	0.41
Judge 3	193	5	72.00	15.58	13.80	0.41	0.41
Judge 27	204	3	60.00	9.35	14.58	0.40	0.40
Judge 32	226	3	64.00	9.35	16.16	0.40	0.40
Judge 18	202	11	123.00	34.27	14.44	0.40	0.40
Judge 4	162	7	85.50	21.81	11.58	0.39	0.39
Judge 19	404	2	92.00	6.23	28.88	0.38	0.38
Judge 34	355	1	75.00	3.12	25.38	0.38	0.38
Judge 37	112	3	46.50	9.35	8.01	0.37	0.37
Judge 13	228	7	105.50	21.81	16.30	0.36	0.36
Judge 48	317	2	80.00	6.23	22.66	0.36	0.36
Judge 29	293	4	98.50	12.46	20.95	0.34	0.34
Judge 36	139	2	49.00	6.23	9.94	0.33	0.33
Judge 9	398	2	105.50	6.23	28.45	0.33	0.33
Judge 31	171	2	58.00	6.23	12.23	0.32	0.32
Judge 15	144	2	52.00	6.23	10.29	0.32	0.32
Judge 21	170	3	70.00	9.35	12.15	0.31	0.31
Judge 49	321	6	137.00	18.69	22.95	0.30	0.30
Judge 23	139	3	64.00	9.35	9.94	0.30	0.30
Judge 28	353	1	97.00	3.12	25.24	0.29	0.29
Judge 35	176	1	54.00	3.12	12.58	0.29	0.29
Judge 43	283	0	72.00	0.00	20.23	0.28	0.28
Judge 1	293	4	122.00	12.46	20.95	0.27	0.27
Judge 12	268	1	82.00	3.12	19.16	0.27	0.27
Judge 14	208	1	68.00	3.12	14.87	0.26	0.26
Judge 41	91	1	38.00	3.12	6.51	0.25	0.25
Judge 45	161	3	90.00	9.35	11.51	0.23	0.23
Judge 20	72	0	23.00	0.00	5.15	0.22	0.22

## 2.2 County Model

Table 5: County Model

<b>Dep. Variable:</b>	y	<b>R-squared (uncentered):</b>	1.000
<b>Model:</b>	OLS	<b>Adj. R-squared (uncentered):</b>	1.000
<b>Method:</b>	Least Squares	<b>F-statistic:</b>	1.261e+33
<b>Date:</b>	Wed, 08 Sep 2021	<b>Prob (F-statistic):</b>	0.00
<b>Time:</b>	12:00:22	<b>Log-Likelihood:</b>	1409.1
<b>No. Observations:</b>	46	<b>AIC:</b>	-2814.
<b>Df Residuals:</b>	44	<b>BIC:</b>	-2810.
<b>Df Model:</b>	2		

	coef	std err	t	P> t	[0.025	0.975]
<b>Plea</b>	0.1324	8.1e-18	1.63e+16	0.000	0.132	0.132
<b>Trial</b>	3.2526	5.3e-16	6.14e+15	0.000	3.253	3.253

<b>Omnibus:</b>	36.252	<b>Durbin-Watson:</b>	1.962
<b>Prob(Omnibus):</b>	0.000	<b>Jarque-Bera (JB):</b>	192.576
<b>Skew:</b>	-1.678	<b>Prob(JB):</b>	1.52e-42
<b>Kurtosis:</b>	12.445	<b>Cond. No.</b>	149.

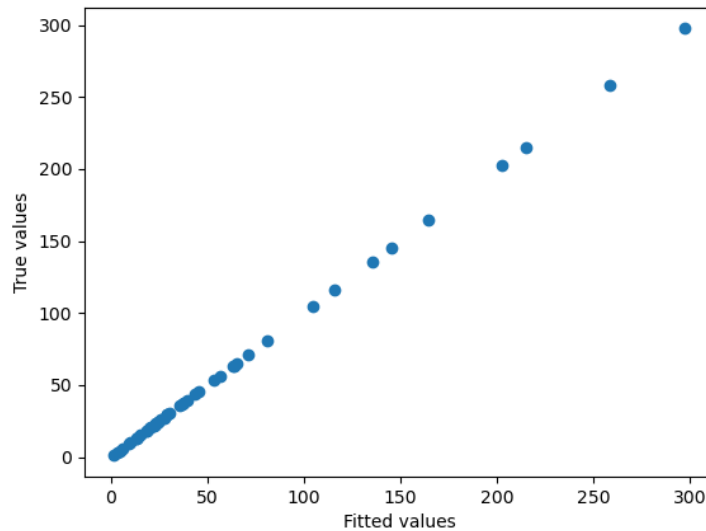


Figure 2: True vs Fitted Values, Judge-County Model

Table 6: Judge Model

Iteration	Beta P	Beta T
0	0.17	4.23
1	0.13	3.25
2	0.13	3.25

Table 7: Utilization at convergence, county model

County	Plea	Trial	Days	TrialDays	PleaDays	Utilization	Idleness
Spartanburg	1063	19	202.50	61.80	140.70	1.00	1.00
Greenville	1608	14	272.00	45.54	212.84	0.95	0.95
Dorchester	291	10	78.00	32.53	38.52	0.91	0.91
Anderson	655	15	161.00	48.79	86.70	0.84	0.84
Oconee	230	2	46.50	6.51	30.44	0.79	0.79
Florence	754	5	146.50	16.26	99.80	0.79	0.79
Aiken	343	11	105.50	35.78	45.40	0.77	0.77
Berkeley	382	4	83.00	13.01	50.56	0.77	0.77
York	777	19	216.50	61.80	102.85	0.76	0.76
Lexington	644	6	141.00	19.52	85.24	0.74	0.74
Charleston	1329	12	291.50	39.03	175.91	0.74	0.74
Barnwell	113	1	25.00	3.25	14.96	0.73	0.73
Horry	655	18	199.50	58.55	86.70	0.73	0.73
Greenwood	370	5	90.00	16.26	48.97	0.72	0.72
Richland	1633	25	417.00	81.31	216.15	0.71	0.71
Cherokee	128	7	57.50	22.77	16.94	0.69	0.69
Georgetown	230	7	79.00	22.77	30.44	0.67	0.67
Sumter	353	5	100.00	16.26	46.72	0.63	0.63
Pickens	254	3	73.00	9.76	33.62	0.59	0.59
Laurens	293	2	82.00	6.51	38.78	0.55	0.55
Orangeburg	327	4	104.00	13.01	43.28	0.54	0.54
Saluda	74	1	25.00	3.25	9.79	0.52	0.52
Kershaw	268	0	68.00	0.00	35.47	0.52	0.52
Jasper	73	1	25.00	3.25	9.66	0.52	0.52
Chesterfield	131	4	59.00	13.01	17.34	0.51	0.51
Marion	171	1	51.00	3.25	22.63	0.51	0.51
Union	147	3	59.00	9.76	19.46	0.50	0.50
Abbeville	118	2	45.00	6.51	15.62	0.49	0.49
Fairfield	62	5	50.00	16.26	8.21	0.49	0.49
Newberry	149	1	48.00	3.25	19.72	0.48	0.48
Lee	91	2	40.50	6.51	12.04	0.46	0.46
Edgefield	116	0	34.00	0.00	15.35	0.45	0.45
Clarendon	158	2	63.50	6.51	20.91	0.43	0.43
Darlington	172	2	68.00	6.51	22.77	0.43	0.43
Bamberg	70	0	22.67	0.00	9.27	0.41	0.41
Colleton	124	1	50.50	3.25	16.41	0.39	0.39
Lancaster	158	1	67.00	3.25	20.91	0.36	0.36
Marlboro	174	0	66.50	0.00	23.03	0.35	0.35
Beaufort	183	4	109.00	13.01	24.22	0.34	0.34
Williamsburg	156	0	61.00	0.00	20.65	0.34	0.34
McCormick	47	0	23.00	0.00	6.22	0.27	0.27
Calhoun	27	0	14.00	0.00	3.57	0.26	0.26
Chester	79	1	59.00	3.25	10.46	0.23	0.23
Hampton	33	0	19.00	0.00	4.37	0.23	0.23
Dillon	74	0	48.00	0.00	9.79	0.20	0.20
Allendale	8	0	14.00	0.00	1.06	0.08	0.08

## 2.3 Judge-County Model

Table 8: County Model

<b>Dep. Variable:</b>	y	<b>R-squared (uncentered):</b>	1.000
<b>Model:</b>	OLS	<b>Adj. R-squared (uncentered):</b>	1.000
<b>Method:</b>	Least Squares	<b>F-statistic:</b>	1.306e+33
<b>Date:</b>	Wed, 08 Sep 2021	<b>Prob (F-statistic):</b>	0.00
<b>Time:</b>	12:00:22	<b>Log-Likelihood:</b>	8998.6
<b>No. Observations:</b>	278	<b>AIC:</b>	-1.799e+04
<b>Df Residuals:</b>	276	<b>BIC:</b>	-1.799e+04
<b>Df Model:</b>	2		

	coef	std err	t	P>  t	[0.025	0.975]
<b>Plea</b>	0.0478	1.72e-18	2.79e+16	0.000	0.048	0.048
<b>Trial</b>	1.7321	8.7e-17	1.99e+16	0.000	1.732	1.732

<b>Omnibus:</b>	127.483	<b>Durbin-Watson:</b>	1.817
<b>Prob(Omnibus):</b>	0.000	<b>Jarque-Bera (JB):</b>	1614.656
<b>Skew:</b>	-1.487	<b>Prob(JB):</b>	0.00
<b>Kurtosis:</b>	14.426	<b>Cond. No.</b>	61.2

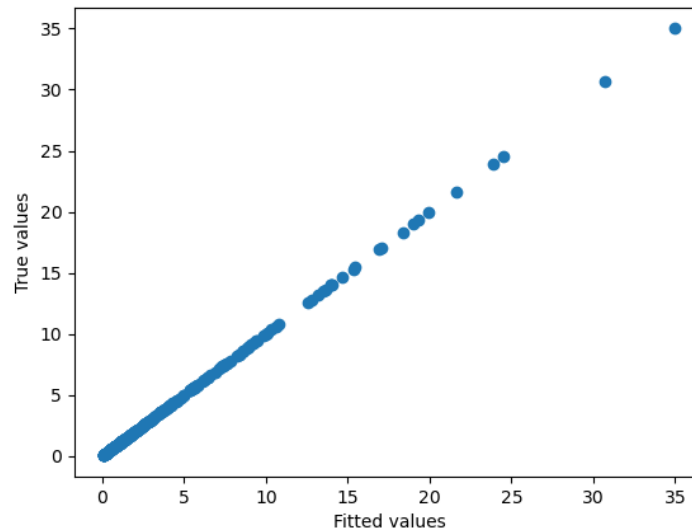


Figure 3: True vs Fitted Values, Judge-County Model



Table 9: Judge-County Model

Iteration	Beta P	Beta T
0	0.13	4.76
1	0.05	1.73
2	0.05	1.73

Table 10: Utilization at convergence, judge-county model

JudgeID	County	Plea	Trial	Days	TrialDays	PleaDays	Utilization	Idleness
Judge 16	Spartanburg	623	3	35.00	5.20	29.80	1.00	1.00
Judge 8	Aiken	36	1	4.00	1.73	1.72	0.86	0.86
Judge 16	Greenville	307	0	21.00	0.00	14.69	0.70	0.70
Judge 42	Oconee	35	1	5.00	1.73	1.67	0.68	0.68
Judge 16	Aiken	12	1	4.00	1.73	0.57	0.58	0.58
Judge 25	Lexington	23	1	5.00	1.73	1.10	0.57	0.57
Judge 8	Beaufort	9	3	10.00	5.20	0.43	0.56	0.56
Judge 46	Charleston	222	0	19.00	0.00	10.62	0.56	0.56
Judge 47	Georgetown	66	3	15.00	5.20	3.16	0.56	0.56
Judge 46	Bamberg	19	0	1.67	0.00	0.91	0.55	0.55
Judge 7	Dorchester	187	9	45.00	15.59	8.95	0.55	0.55
Judge 38	Berkeley	40	2	10.00	3.46	1.91	0.54	0.54
Judge 46	Horry	53	0	5.00	0.00	2.54	0.51	0.51
Judge 25	Greenville	210	0	20.00	0.00	10.05	0.50	0.50
Judge 35	Colleton	16	1	5.00	1.73	0.77	0.50	0.50
Judge 24	York	207	12	62.50	20.79	9.90	0.49	0.49
Judge 5	Horry	189	1	22.00	1.73	9.04	0.49	0.49
Judge 19	York	153	0	15.00	0.00	7.32	0.49	0.49
Judge 26	Anderson	252	4	39.00	6.93	12.06	0.49	0.49
Judge 38	Sumter	4	1	4.00	1.73	0.19	0.48	0.48
Judge 28	Richland	102	1	14.00	1.73	4.88	0.47	0.47
Judge 6	Florence	285	0	29.00	0.00	13.63	0.47	0.47
Judge 15	Orangeburg	3	1	4.00	1.73	0.14	0.47	0.47
Judge 10	Greenwood	24	2	10.00	3.46	1.15	0.46	0.46
Judge 42	Pickens	58	1	10.00	1.73	2.77	0.45	0.45
Judge 18	Horry	103	6	34.00	10.39	4.93	0.45	0.45
Judge 10	York	1	1	4.00	1.73	0.05	0.44	0.44
Judge 37	Clarendon	10	1	5.00	1.73	0.48	0.44	0.44
Judge 5	Richland	245	3	39.00	5.20	11.72	0.43	0.43
Judge 50	Richland	163	8	50.00	13.86	7.80	0.43	0.43
Judge 42	Greenville	180	1	24.00	1.73	8.61	0.43	0.43
Judge 24	Cherokee	44	2	13.00	3.46	2.10	0.43	0.43
Judge 43	Charleston	67	0	7.50	0.00	3.21	0.43	0.43
Judge 17	Greenville	142	1	20.00	1.73	6.79	0.43	0.43
Judge 41	Berkeley	8	1	5.00	1.73	0.38	0.42	0.42
Judge 46	Spartanburg	44	0	5.00	0.00	2.10	0.42	0.42
Judge 44	Greenville	209	0	24.00	0.00	10.00	0.42	0.42
Judge 46	Lexington	87	0	10.00	0.00	4.16	0.42	0.42
Judge 39	Oconee	7	1	5.00	1.73	0.33	0.41	0.41
Judge 33	Darlington	7	1	5.00	1.73	0.33	0.41	0.41
Judge 39	Anderson	203	2	32.00	3.46	9.71	0.41	0.41
Judge 19	Lexington	43	0	5.00	0.00	2.06	0.41	0.41
Judge 19	Sumter	41	1	9.00	1.73	1.96	0.41	0.41
Judge 26	Lexington	17	0	2.00	0.00	0.81	0.41	0.41
Judge 39	Barnwell	17	0	2.00	0.00	0.81	0.41	0.41
Judge 39	Lexington	113	2	22.00	3.46	5.41	0.40	0.40
Judge 26	Greenwood	31	1	8.00	1.73	1.48	0.40	0.40
Judge 16	Pickens	41	0	5.00	0.00	1.96	0.39	0.39
Judge 21	Charleston	50	2	15.00	3.46	2.39	0.39	0.39
Judge 3	Charleston	82	2	19.00	3.46	3.92	0.39	0.39
Judge 15	Charleston	4	1	5.00	1.73	0.19	0.38	0.38
Judge 9	Chesterfield	8	0	1.00	0.00	0.38	0.38	0.38
Judge 4	Fairfield	7	2	10.00 <sub>10</sub>	3.46	0.33	0.38	0.38
Judge 6	Horry	140	6	45.00	10.39	6.70	0.38	0.38
Judge 22	Greenville	311	2	49.00	3.46	14.88	0.37	0.37
Judge 30	Anderson	75	6	38.00	10.39	3.59	0.37	0.37
Judge 24	Union	40	1	10.00	1.73	1.91	0.36	0.36

### 3 Iterative Idleness Estimation Taking Mins

**Step 0:** We estimate the model,  $\text{Days}_j = \beta_t \text{Trial}_j + \beta_p \text{Plea}_j + \epsilon_j$ .

**Steps 1-n:** We then use the estimates of  $\beta_t^{(1)}$  and  $\beta_p^{(1)}$  to estimate the expected number of days it would take each judge to complete their work. Mathematically:  $\text{Expected Days}_j^{(1)} = \beta_p^{(1)} \cdot \text{Plea}_j + \beta_t^{(1)} \cdot \text{Trial}_j$ . We would then set  $\text{Days}_j^{(1)} = \min(\text{Days}_j, \text{Expected Days}_j^{(1)})$ . We then estimate the model  $\text{Days}_j^{(1)} = \beta_t \text{Trial}_j + \beta_p \text{Plea}_j + \epsilon_j$  and repeat until convergence.

#### 3.1 Judge Model

Table 11: Judge Model

<b>Dep. Variable:</b>	y	<b>R-squared (uncentered):</b>	1.000
<b>Model:</b>	OLS	<b>Adj. R-squared (uncentered):</b>	1.000
<b>Method:</b>	Least Squares	<b>F-statistic:</b>	4.033e+32
<b>Date:</b>	Wed, 08 Sep 2021	<b>Prob (F-statistic):</b>	0.00
<b>Time:</b>	12:00:21	<b>Log-Likelihood:</b>	1541.8
<b>No. Observations:</b>	50	<b>AIC:</b>	-3080.
<b>Df Residuals:</b>	48	<b>BIC:</b>	-3076.
<b>Df Model:</b>	2		

	coef	std err	t	P> t	[0.025	0.975]
<b>Plea</b>	0.0715	5.92e-18	1.21e+16	0.000	0.071	0.071
<b>Trial</b>	3.1154	3.49e-16	8.94e+15	0.000	3.115	3.115

<b>Omnibus:</b>	29.779	<b>Durbin-Watson:</b>	0.611
<b>Prob(Omnibus):</b>	0.000	<b>Jarque-Bera (JB):</b>	60.328
<b>Skew:</b>	-1.784	<b>Prob(JB):</b>	7.94e-14
<b>Kurtosis:</b>	7.027	<b>Cond. No.</b>	85.5

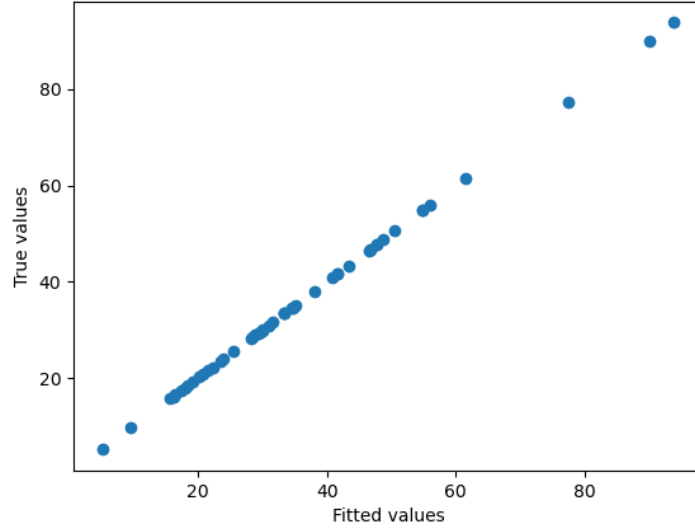


Figure 4: True vs Fitted Values, Judge Model

Table 12: Judge Model

Iteration	Beta P	Beta T
0	0.15	6.48
1	0.07	3.12
2	0.07	3.12

### 3.2 County Model

Table 13: County Model

<b>Dep. Variable:</b>	y	<b>R-squared (uncentered):</b>	0.995
<b>Model:</b>	OLS	<b>Adj. R-squared (uncentered):</b>	0.995
<b>Method:</b>	Least Squares	<b>F-statistic:</b>	4553.
<b>Date:</b>	Wed, 08 Sep 2021	<b>Prob (F-statistic):</b>	1.01e-51
<b>Time:</b>	11:40:08	<b>Log-Likelihood:</b>	-157.08
<b>No. Observations:</b>	46	<b>AIC:</b>	318.2
<b>Df Residuals:</b>	44	<b>BIC:</b>	321.8
<b>Df Model:</b>	2		

	coef	std err	t	P>  t	[0.025	0.975]
<b>Plea</b>	0.1445	0.005	29.177	0.000	0.134	0.154
<b>Trial</b>	4.4126	0.324	13.619	0.000	3.760	5.066

<b>Omnibus:</b>	56.300	<b>Durbin-Watson:</b>	2.055
<b>Prob(Omnibus):</b>	0.000	<b>Jarque-Bera (JB):</b>	376.354
<b>Skew:</b>	-3.024	<b>Prob(JB):</b>	1.89e-82
<b>Kurtosis:</b>	15.641	<b>Cond. No.</b>	149.

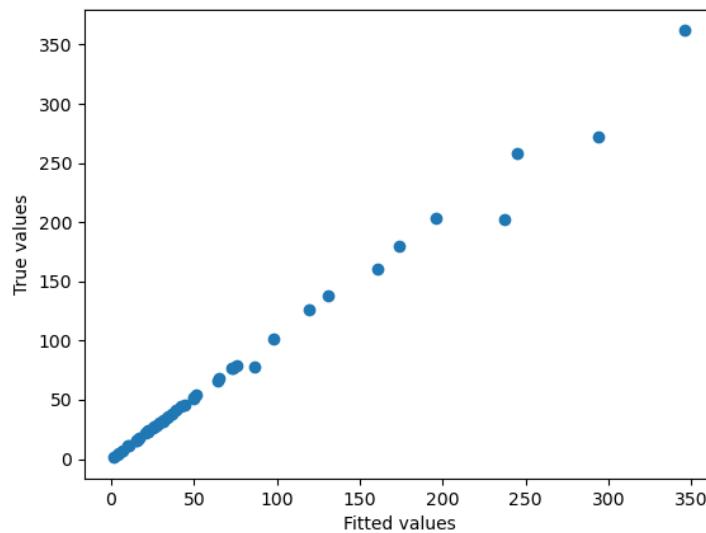


Figure 5: True vs Fitted Values, Judge-County Model

Table 14: Judge Model

Iteration	Beta P	Beta T
0	0.17	4.23
1	0.15	4.41
2	0.14	4.41

### 3.3 Judge-County Model

Table 15: County Model

Dep. Variable:	y	R-squared (uncentered):	0.986
Model:	OLS	Adj. R-squared (uncentered):	0.986
Method:	Least Squares	F-statistic:	9809.
Date:	Wed, 08 Sep 2021	Prob (F-statistic):	4.19e-257
Time:	11:40:09	Log-Likelihood:	-491.26
No. Observations:	278	AIC:	986.5
Df Residuals:	276	BIC:	993.8
Df Model:	2		

	coef	std err	t	P>  t	[0.025	0.975]
Plea	0.0668	0.001	58.241	0.000	0.065	0.069
Trial	4.2463	0.058	72.973	0.000	4.132	4.361

Omnibus:	507.684	Durbin-Watson:	1.990
Prob(Omnibus):	0.000	Jarque-Bera (JB):	235811.290
Skew:	-10.399	Prob(JB):	0.00
Kurtosis:	144.157	Cond. No.	61.2

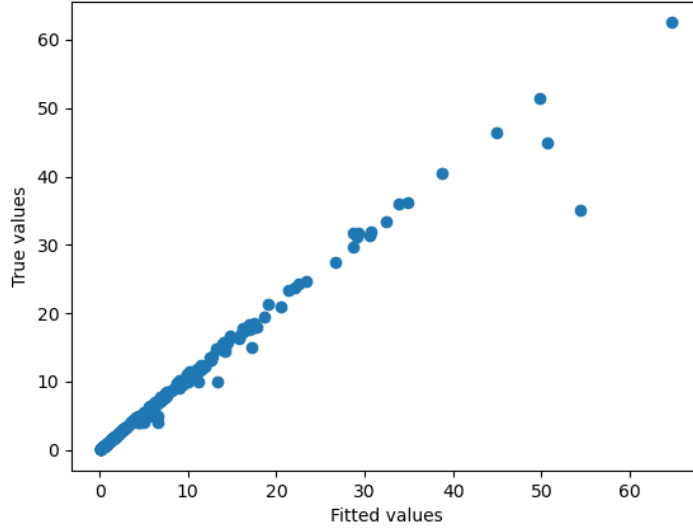


Figure 6: True vs Fitted Values, Judge-County Model

Table 16: Judge-County Model

Iteration	Beta P	Beta T
0	0.13	4.76
1	0.10	4.49
2	0.09	4.34
3	0.07	4.28
4	0.07	4.25

## 4 Fixed Effects Model

We know from our exploratory analysis that there is large heterogeneity in activity amongst counties. Therefore, it is likely that the county that a judge happens to be in also significantly affects the number of pleas he is able to process. One way we could try to incorporate both judge and county idleness, would be to use a fixed effects model. Here, the unit of observation would be a judge-county combination. For each judge county combination,  $i$  with judge  $j$  and county  $c$ , we could run the regression  $\text{Days}_i = \alpha_j + \delta_c + \beta_p \text{Plea}_i + \beta_t \text{Trial}_i + \epsilon_i$ . **Pros:** this would flexibly control for both judge and county fixed effects. **Cons:** We only have 248 observations of judge county combinations, and we would be trying to estimate around 96 parameters.

## 4.1 Model with Judge and County Fixed Effects

Table 17: Fixed Effects Model

	<i>Dependent variable:</i>
	Days
Plea	0.099*** (0.009)
Trial	3.714*** (0.399)
Observations	278
R <sup>2</sup>	0.801
Adjusted R <sup>2</sup>	0.696
Residual Std. Error	7.380 (df = 181)
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01

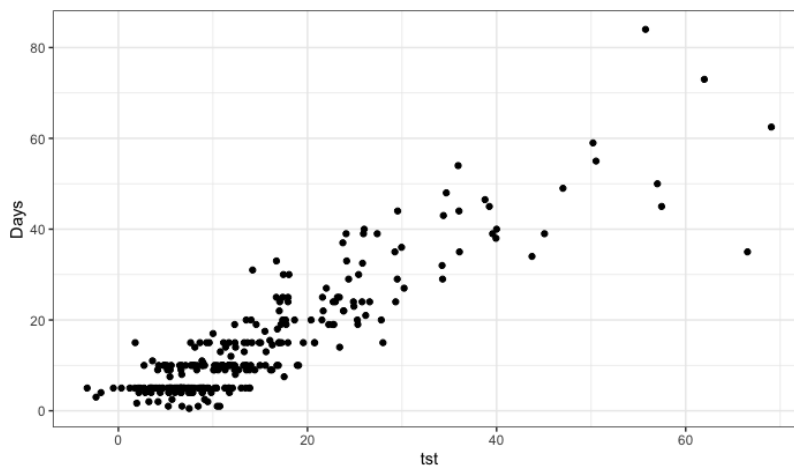


Figure 7: True vs Fitted Values, fixed effects model

## 4.2 Model with Judge Fixed Effects

Note, the unit of observation here,  $i$ , is the judge-county combination. The regression we are running here is:  $\text{Days}_i = \alpha_j + \beta_p \text{Plea}_i + \beta_t \text{Trial}_i + \epsilon_i$



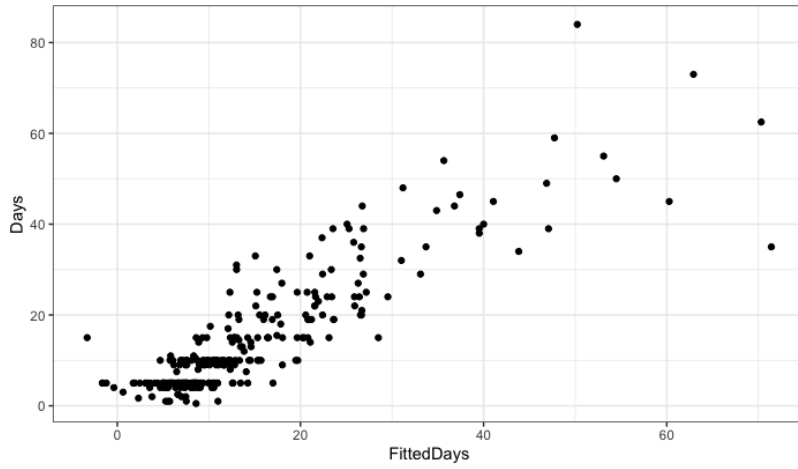


Figure 8: True vs Fitted Values, fixed effects model

Table 18: Model with Judge Fixed effects, table continues on next page

	<i>Dependent variable:</i>
	Days
Plea	0.105*** (0.007)
Trial	3.861*** (0.349)
Judge 1	15.166*** (3.192)
Judge 10	5.090** (2.532)
Judge 11	10.027** (4.280)
Judge 12	7.506** (2.907)
Judge 13	7.795*** (2.697)
Judge 14	6.221** (2.901)
Judge 15	4.168 (2.681)
Judge 16	-5.497* (2.857)
Judge 17	7.804** (3.573)
Judge 18	9.869*** (3.243)
Judge 19	4.191* (2.256)
Judge 2	9.071*** (3.232)
Judge 20	3.862 (3.544)
Judge 21	5.074** (2.509)
Judge 22	6.544** (3.230)
Judge 23	8.460** (3.552)
Judge 24	2.276 (3.787)
Judge 25	4.645 (2.956)
Judge 26	5.215* (2.711)
Judge 27	5.405* (3.180)
Observations	278
R <sup>2</sup>	0.897
Adjusted R <sup>2</sup>	0.873
Residual Std. Error	7.083 (df = 226)
F Statistic	37.788*** (df = 52; 226)

*Note:*

\*p&lt;0.1; \*\*p&lt;0.05; \*\*\*p&lt;0.01

Table 19: Model with Judge Fixed effects, continued

		<i>Dependent variable:</i>
		Days
Judge 28		6.515** (2.523)
Judge 29		8.555*** (2.910)
Judge 3		4.491 (3.186)
Judge 30		8.495*** (3.231)
Judge 31		10.782*** (4.107)
Judge 32		4.786 (2.903)
Judge 33		5.387* (2.939)
Judge 34		7.227** (3.594)
Judge 35		7.920** (3.553)
Judge 36		5.340* (3.173)
Judge 37		3.862 (2.896)
Judge 38		3.776 (2.906)
Judge 39		2.007 (2.926)
Judge 4		6.081** (2.915)
Judge 40		8.950 (7.257)
Judge 41		12.298** (5.017)
Judge 42		0.685 (3.572)
Judge 43		7.053** (2.912)
Judge 44		3.976 (2.925)
Judge 45		10.256*** (2.898)
Judge 46		0.315 (2.716)
Judge 47		10.001*** (3.601)
Judge 48		6.506** (2.913)
Judge 49		16.034*** (3.203)
Judge 5		2.240 (3.632)
Judge 50	19	6.510** (2.724)
Judge 6		3.219 (3.640)
Judge 7		5.911**