

## NFL Ticket Prices and Year Effects

**Don't forget: This is a favorite coefficient model!**

```
. reg rprice pop pop2 rpci wprcnt1 po5 otherpro newstad tempstad cap95 twoteam exp
reloc
```

Source	SS	df	MS	Number of obs =	599
Model	69051.4412	12	5754.28676	F( 12, 586) =	36.14
Residual	93314.6105	586	159.23995	Prob > F =	0.0000
				R-squared =	0.4253
				Adj R-squared =	0.4135
Total	162366.052	598	271.515137	Root MSE =	12.619

rprice	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
pop	3.138094	.7278508	4.31	0.000	1.70858 4.567608
pop2	-.0396786	.0267363	-1.48	0.138	-.0921893 .0128322
rpci	.001194	.0001069	11.17	0.000	.0009841 .001404
wprcnt1	11.15657	3.24261	3.44	0.001	4.788015 17.52512
po5	1.274853	.4342834	2.94	0.003	.421912 2.127795
otherpro	-3.873928	.8990734	-4.31	0.000	-5.639726 -2.108129
newstad	12.29005	2.87914	4.27	0.000	6.635359 17.94474
tempstad	1.218647	4.993478	0.24	0.807	-8.588647 11.02594
cap95	3.329608	1.190485	2.80	0.005	.9914708 5.667745
twoteam	-5.686587	2.510623	-2.27	0.024	-10.6175 -4.755672
exp	-13.91609	9.43308	-1.48	0.141	-32.44286 4.610667
reloc	4.085693	7.561305	0.54	0.589	-10.76487 18.93625
_cons	3.98185	4.368631	0.91	0.362	-4.59823 12.56193

```
. predict resid, res
```

**Criticism:** So we've captured lots of team effects, but what about league-wide effects perhaps due to NFL marketing or national telecasts or whatever. Not sure what those might be... but let's at least see if maybe those effects vary by year.

**Any correlation between the residuals and yr?**

```
. reg resid yr
```

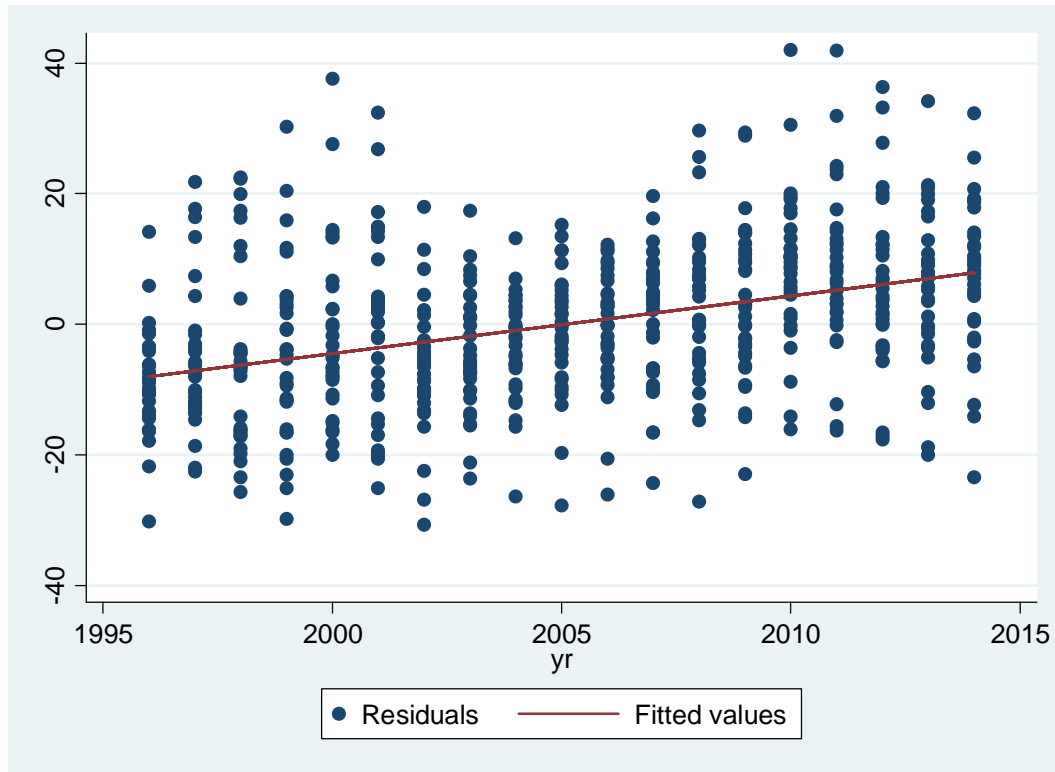
Source	SS	df	MS	Number of obs =	599
Model	13708.9936	1	13708.9936	F( 1, 597) =	102.81
Residual	79605.6167	597	133.342741	Prob > F =	0.0000
				R-squared =	0.1469
				Adj R-squared =	0.1455
Total	93314.6102	598	156.044499	Root MSE =	11.547

resid	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
yr	.8783729	.0866285	10.14	0.000	.7082393 1.048507
_cons	-1761.23	173.6999	-10.14	0.000	-2102.367 -1420.093

**t = 10.14!!!**

```
. predict rhat
(option xb assumed; fitted values)
```

```
. twoway (scatter res yr) (line rhat yr)
```



**So add yr to the model to capture time trend (yr) effects.**

```
. reg rprice pop pop2 rpci wprcnt1 po5 otherpro newstad tempstad cap95 twoteam exp
reloc yr
```

Source	SS	df	MS	Number of obs =	599
Model	88576.3042	13	6813.56186	F( 13, 585) =	54.02
Residual	73789.7475	585	126.13632	Prob > F	= 0.0000
Total	162366.052	598	271.515137	R-squared	= 0.5455
				Adj R-squared	= 0.5354
				Root MSE	= 11.231

rprice	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
pop	3.206442	.6478166	4.95	0.000	1.934112 4.478771
pop2	-.0651326	.0238833	-2.73	0.007	-.1120401 -.018225
rpci	.0005249	.0001093	4.80	0.000	.0003103 .0007396
wprcnt1	12.62162	2.888352	4.37	0.000	6.948821 18.29442
po5	1.783045	.3886681	4.59	0.000	1.01969 2.546399
<b>otherpro</b>	<b>-2.541129</b>	<b>.8073217</b>	<b>-3.15</b>	<b>0.002</b>	<b>-4.12673 -1.955267</b>
newstad	15.28358	2.57373	5.94	0.000	10.2287 20.33845
tempstad	1.778679	4.444465	0.40	0.689	-6.950372 10.50773
cap95	1.839897	1.066286	1.73	0.085	-.2543179 3.934111
twoteam	.3182346	2.286006	0.14	0.889	-4.171544 4.808013
exp	-8.839752	8.405428	-1.05	0.293	-25.34824 7.66874
reloc	7.36799	6.734794	1.09	0.274	-5.859329 20.59531
<b>yr</b>	<b>1.251012</b>	<b>.1005512</b>	<b>12.44</b>	<b>0.000</b>	<b>1.053526 1.448497</b>
_cons	-2478.255	199.55	-12.42	0.000	-2870.177 -2086.333

## Any omitted variable bias caused by ignoring trend effects in the first model?

```
-----
. esttab, r2 ar2 scalar(F rmse)
```

	(1)	(2)
	rprice	rprice
pop	3.138*** (4.31)	3.206*** (4.95)
pop2	-0.0397 (-1.48)	-0.0651** (-2.73)
rpci	0.00119*** (11.17)	0.000525*** (4.80)
wprcnt1	11.16*** (3.44)	12.62*** (4.37)
po5	1.275** (2.94)	1.783*** (4.59)
<b>otherpro</b>	<b>-3.874***</b> (-4.31)	<b>-2.541**</b> (-3.15)
newstad	12.29*** (4.27)	15.28*** (5.94)
tempstad	1.219 (0.24)	1.779 (0.40)
cap95	3.330** (2.80)	1.840 (1.73)
twoteam	-5.687* (-2.27)	0.318 (0.14)
exp	-13.92 (-1.48)	-8.840 (-1.05)
reloc	4.086 (0.54)	7.368 (1.09)
yr		1.251*** (12.44)
_cons	3.982 (0.91)	-2478.3*** (-12.42)
N	599	599
R-sq	0.425	0.546
adj. R-sq	0.414	0.535
F	36.14	54.02
rmse	12.62	11.23

t statistics in parentheses

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001

**But are the annual effects really linear as required in the previous model?**

**Add annual dummies to the model to allow for *separate* year effects.  
(Use i.yr to create the annual dummies.)**

```
. reg rprice pop pop2 rpci wprcnt1 po5 otherpro newstad tempstad cap95 twoteam exp
reloc i.yr
```

Source	SS	df	MS	Number of obs =	599
Model	91167.6495	30	3038.92165	F( 30, 568) =	24.24
Residual	71198.4022	568	125.3493	Prob > F =	0.0000
				R-squared =	0.5615
				Adj R-squared =	0.5383
Total	162366.052	598	271.515137	Root MSE =	11.196

rprice	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
pop	3.289718	.6558425	5.02	0.000	2.001545 4.577891
pop2	-.0685916	.0241751	-2.84	0.005	-.116075 -.0211082
rpci	.0004846	.0001158	4.19	0.000	.0002572 .000712
wprcnt1	12.75475	2.887695	4.42	0.000	7.082885 18.42661
po5	1.804066	.3894067	4.63	0.000	1.039213 2.568919
otherpro	-2.565421	.8076439	-3.18	0.002	-4.151755 -.9790883
newstad	15.35523	2.592659	5.92	0.000	10.26286 20.4476
tempstad	1.85128	4.474112	0.41	0.679	-6.936543 10.6391
cap95	1.767233	1.118305	1.58	0.115	-.4292848 3.963751
twoteam	.7708568	2.316913	0.33	0.739	-3.779907 5.32162
exp	-7.750788	8.469636	-0.92	0.361	-24.38642 8.884841
reloc	8.372919	6.757957	1.24	0.216	-4.900719 21.64656
yr					
1997	4.615833	2.895521	1.59	0.111	-1.071402 10.30307
1998	6.105124	2.911888	2.10	0.036	.3857414 11.82451
1999	8.428454	2.952745	2.85	0.004	2.628823 14.22809
2000	11.96503	2.959083	4.04	0.000	6.152952 17.77711
2001	14.15559	3.014953	4.70	0.000	8.233774 20.07741
2002	8.176639	3.023545	2.70	0.007	2.237945 14.11533
2003	10.69216	2.989402	3.58	0.000	4.820524 16.56379
2004	11.94378	3.024475	3.95	0.000	6.003258 17.8843
2005	14.46041	3.030473	4.77	0.000	8.508113 20.41272
2006	15.4295	3.052198	5.06	0.000	9.434532 21.42448
2007	18.23985	3.128916	5.83	0.000	12.09419 24.38551
2008	20.3127	3.120544	6.51	0.000	14.18349 26.44191
2009	21.20822	3.153701	6.72	0.000	15.01388 27.40256
2010	24.57104	3.006911	8.17	0.000	18.66502 30.47706
2011	23.93983	3.003614	7.97	0.000	18.04028 29.83937
2012	22.4657	3.057938	7.35	0.000	16.45945 28.47195
2013	23.52936	3.129368	7.52	0.000	17.38282 29.67591
2014	24.56604	3.118118	7.88	0.000	18.44159 30.69049
_cons	16.54166	4.40317	3.76	0.000	7.893176 25.19014

**Fairly linear... but what happened in 2003-06?**

**And do we really have to look at all those annual coefficients? This is a favorite coefficient model... we just want to capture annual effects in the model... but don't make us look at them!.**

**Bring on areg and absorb( ).**

```
. areg rprice pop pop2 rpci wprcnt1 po5 otherpro newstad tempstad cap95 twoteam exp
reloc, absorb(yr)
```

```
Linear regression, absorbing indicators          Number of obs =          599
                                                F( 12,    568) =         30.00
                                                Prob > F      =          0.0000
                                                R-squared     =          0.5615
                                                Adj R-squared =          0.5383
                                                Root MSE     =         11.1960
```

rprice	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
pop	3.289718	.6558425	5.02	0.000	2.001545	4.577891
pop2	-.0685916	.0241751	-2.84	0.005	-.116075	-.0211082
rpci	.0004846	.0001158	4.19	0.000	.0002572	.000712
wprcnt1	12.75475	2.887695	4.42	0.000	7.082885	18.42661
po5	1.804066	.3894067	4.63	0.000	1.039213	2.568919
otherpro	-2.565421	.8076439	-3.18	0.002	-4.151755	-.9790883
newstad	15.35523	2.592659	5.92	0.000	10.26286	20.4476
tempstad	1.85128	4.474112	0.41	0.679	-6.936543	10.6391
cap95	1.767233	1.118305	1.58	0.115	-.4292848	3.963751
twoteam	.7708568	2.316913	0.33	0.739	-3.779907	5.32162
exp	-7.750788	8.469636	-0.92	0.361	-24.38642	8.884841
reloc	8.372919	6.757957	1.24	0.216	-4.900719	21.64656
_cons	31.66316	4.649922	6.81	0.000	22.53002	40.7963
yr	F(18, 568) =		9.802	0.000	(19 categories)	

**Got rid of those nuisance coefficients!**

**So to summarize the results.... and Fixed Effects.**

	(1)	(2)	(3)	(4)
	rprice	rprice	rprice	rprice
		<u>add yr</u>	<u>i.yr</u>	<u>areg yr</u>
pop	3.138*** (4.31)	3.206*** (4.95)	3.290*** (5.02)	3.290*** (5.02)
pop2	-0.0397 (-1.48)	-0.0651** (-2.73)	-0.0686** (-2.84)	-0.0686** (-2.84)
rpci	0.00119*** (11.17)	0.000525*** (4.80)	0.000485*** (4.19)	0.000485*** (4.19)
wprcnt1	11.16*** (3.44)	12.62*** (4.37)	12.75*** (4.42)	12.75*** (4.42)
po5	1.275** (2.94)	1.783*** (4.59)	1.804*** (4.63)	1.804*** (4.63)
<b>otherpro</b>	<b>-3.874***</b> (-4.31)	<b>-2.541**</b> (-3.15)	<b>-2.565**</b> (-3.18)	<b>-2.565**</b> (-3.18)
newstad	12.29*** (4.27)	15.28*** (5.94)	15.36*** (5.92)	15.36*** (5.92)
tempstad	1.219 (0.24)	1.779 (0.40)	1.851 (0.41)	1.851 (0.41)
cap95	3.330** (2.80)	1.840 (1.73)	1.767 (1.58)	1.767 (1.58)
twoteam	-5.687* (-2.27)	0.318 (0.14)	0.771 (0.33)	0.771 (0.33)
exp	-13.92 (-1.48)	-8.840 (-1.05)	-7.751 (-0.92)	-7.751 (-0.92)
reloc	4.086 (0.54)	7.368 (1.09)	8.373 (1.24)	8.373 (1.24)
yr		1.251*** (12.44)		
_cons	3.982 (0.91)	-2478.3*** (-12.42)	16.54*** (3.76)	31.66*** (6.81)

**Yr Fixed Effects**

	No	No	Yes	Yes
N	599	599	599	599
R-sq	0.425	0.546	0.561	0.561
adj. R-sq	0.414	0.535	0.538	0.538
F	36.14	54.02	24.24	30.00
rmse	12.62	11.23	11.20	11.20

t statistics in parentheses

\* p<0.05, \*\* p<0.01, \*\*\* p<0.001