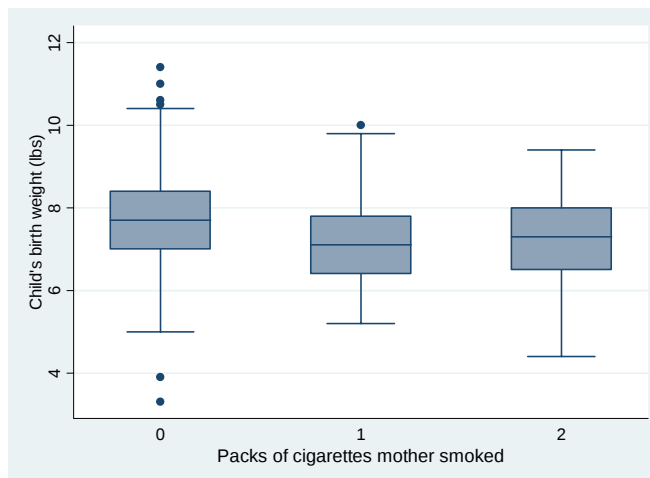


Stata Output for ANCOVA Section, Spring 2006

1. One-Way ANOVA on Birth Weights

```
. graph box weight,over(ms_gp) b1title("Packs of cigarettes mother smoked")
```



```
. anova weight ms_gp
```

Number of obs = 680 R-squared = 0.0502
Root MSE = 1.06613 Adj R-squared = 0.0474

Source	Partial SS	df	MS	F	Prob > F
Model	40.7012466	2	20.3506233	17.90	0.0000
ms_gp	40.7012466	2	20.3506233	17.90	0.0000
Residual	769.4943	677	1.13662378		
Total	810.195546	679	1.19321877		

```
. anova,regress /* get contrasts vs. last group*/
```

Source	SS	df	MS	Number of obs = 680
Model	40.7012466	2	20.3506233	F(2, 677) = 17.90
Residual	769.4943	677	1.13662378	Prob > F = 0.0000
Total	810.195546	679	1.19321877	R-squared = 0.0502
				Adj R-squared = 0.0474
				Root MSE = 1.0661

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_cons	7.266154	.0935054	77.71	0.000	7.082558 7.449749
ms_gp					
1	.4666546	.1082891	4.31	0.000	.2540318 .6792774
2	-.0448521	.1243738	-0.36	0.718	-.2890568 .1993527
3	(dropped)				

```
. lincom(_b[ms_gp[1]]-_b[ms_gp[2]]) /*non- vs. light-smoke contrast*/
```

```
( 1) ms_gp[1] - ms_gp[2] = 0
```

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
(1)	.5115066	.0985335	5.19	0.000	.3180387 .7049746

```
. *get same analysis using xi command (parameter constraints differ)
. xi:regress weight i.ms_gp
i.ms_gp      _Ims_gp_0-2      (naturally coded; _Ims_gp_0 omitted)
```

Source	SS	df	MS	Number of obs =	680
Model	40.7012466	2	20.3506233	F(2, 677) =	17.90
Residual	769.4943	677	1.13662378	Prob > F =	0.0000
Total	810.195546	679	1.19321877	R-squared =	0.0502
				Adj R-squared =	0.0474
				Root MSE =	1.0661

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_Ims_gp_1	-.5115066	.0985335	-5.19	0.000	-.7049746 -.3180387
_Ims_gp_2	-.4666546	.1082891	-4.31	0.000	-.6792774 -.2540318
_cons	7.732808	.0546193	141.58	0.000	7.625565 7.840052

```
. testparm _Ims_gp*
```

```
( 1) _Ims_gp_1 = 0
( 2) _Ims_gp_2 = 0
```

```
F( 2, 677) = 17.90
Prob > F = 0.0000
```

```
. lincom(_b[_Ims_gp_1]-_b[_Ims_gp_2])
```

```
( 1) _Ims_gp_1 - _Ims_gp_2 = 0
```

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
(1)	-.0448521	.1243738	-0.36	0.718	-.2890568 .1993527

2. ANCOVA on Birth Weights

```
. *fit pre-pregnancy weight as covariate using anova command
. anova weight ms_gp mweight,cont(mweight)
```

```
Number of obs = 680
Root MSE = 1.04627
R-squared = 0.0866
Adj R-squared = 0.0826
```

Source	Partial SS	df	MS	F	Prob > F
Model	70.1883192	3	23.3961064	21.37	0.0000
ms_gp	30.4085011	2	15.2042506	13.89	0.0000
mweight	29.4870727	1	29.4870727	26.94	0.0000
Residual	740.007227	676	1.09468525		
Total	810.195546	679	1.19321877		

```
. anova,regress /*get contrasts vs. last group*/
```

Source	SS	df	MS	Number of obs =	680
Model	70.1883192	3	23.3961064	F(3, 676) =	21.37
Residual	740.007227	676	1.09468525	Prob > F =	0.0000
Total	810.195546	679	1.19321877	R-squared =	0.0866
				Adj R-squared =	0.0826
				Root MSE =	1.0463

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_cons	5.751662	.3058953	18.80	0.000	5.151043 6.352282
ms_gp					
1	.4477316	.106335	4.21	0.000	.238945 .6565182

	2	.0318146	.1229483	0.26	0.796	-.2095919	.2732211
	3	(dropped)					
mweight		.0118683	.0022868	5.19	0.000	.0073784	.0163583

```
. lincom(_b[ms_gp[1]]-_b[ms_gp[2]]) /*non- vs. light-smoke contrast*/
```

```
( 1) ms_gp[1] - ms_gp[2] = 0
```

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
(1)	.415917	.098437	4.23	0.000	.222638 .6091959

```
. *repeat using xi (get different contrasts)
```

```
. xi: regress weight i.ms_gp mweight
```

```
i.ms_gp      _Imsgp_0-2      (naturally coded; _Imsgp_0 omitted)
```

Source	SS	df	MS	Number of obs =	680
Model	70.1883192	3	23.3961064	F(3, 676) =	21.37
Residual	740.007227	676	1.09468525	Prob > F =	0.0000
Total	810.195546	679	1.19321877	R-squared =	0.0866
				Adj R-squared =	0.0826
				Root MSE =	1.0463

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_Imsgp_1	-.415917	.098437	-4.23	0.000	-.6091959 -.222638
_Imsgp_2	-.4477316	.106335	-4.21	0.000	-.6565182 -.238945
mweight	.0118683	.0022868	5.19	0.000	.0073784 .0163583
_cons	6.199394	.300276	20.65	0.000	5.609808 6.78898

```
. testparm _Imsgp*
```

```
( 1) _Imsgp_1 = 0
```

```
( 2) _Imsgp_2 = 0
```

```

F( 2, 676) = 13.89
Prob > F = 0.0000

```

```
. lincom(_b[_Imsgp_1]-_b[_Imsgp_2])
```

```
( 1) _Imsgp_1 - _Imsgp_2 = 0
```

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
(1)	.0318146	.1229483	0.26	0.796	-.2095919 .2732211

```
. *get fitted lines plotted on scatter plots
```

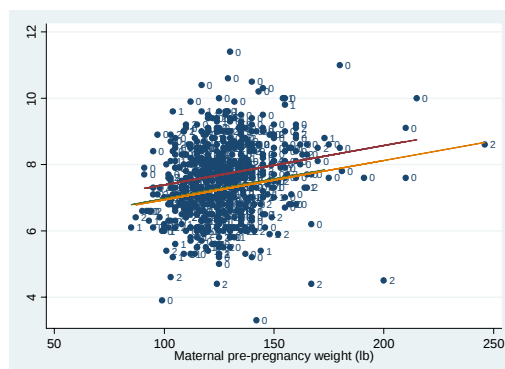
```
. predict yhat
```

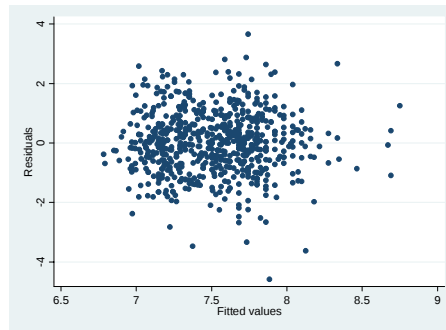
```
(option xb assumed; fitted values)
```

```
. twoway (scatter weight mweight, mlabel(ms_gp)) ///
```

```
> (line yhat mweight if ms_gp==0) (line yhat mweight if ms_gp==1) ///
```

```
> (line yhat mweight if ms_gp ==2), legend(off)
```



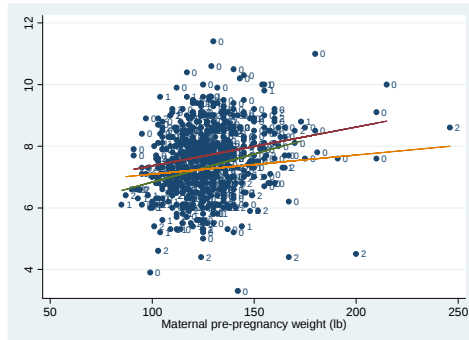


3. ANCOVA with interaction

```
. *fit unequal slopes
. anova weight ms_gp mweight ms_gp*mweight,cont(mweight)
```

Number of obs = 680 R-squared = 0.0904
 Root MSE = 1.04566 Adj R-squared = 0.0836

Source	Partial SS	df	MS	F	Prob > F
Model	73.234203	5	14.6468406	13.40	0.0000
ms_gp	2.87983773	2	1.43991886	1.32	0.2687
mweight	23.4430881	1	23.4430881	21.44	0.0000
ms_gp*mweight	3.04588372	2	1.52294186	1.39	0.2491
Residual	736.961343	674	1.09341446		
Total	810.195546	679	1.19321877		



```
. anova, regress
```

Source	SS	df	MS	Number of obs = 680
Model	73.234203	5	14.6468406	F(5, 674) = 13.40
Residual	736.961343	674	1.09341446	Prob > F = 0.0000
Total	810.195546	679	1.19321877	R-squared = 0.0904
				Adj R-squared = 0.0836
				Root MSE = 1.0457

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_cons	6.471542	.5897484	10.97	0.000	5.313577 7.629508
ms_gp					
1	-.3684091	.7043394	-0.52	0.601	-1.751372 1.014554
2	-1.470025	.9305639	-1.58	0.115	-3.297178 .3571275
3	(dropped)				
mweight	.006227	.0045654	1.36	0.173	-.002737 .015191
ms_gp*mweight					
1	.0063864	.0054363	1.17	0.241	-.0042878 .0170606
2	.0120959	.0074636	1.62	0.106	-.0025588 .0267506
3	(dropped)				

Look at the 3 separate linear regressions

```
. *do 3 separate linear regressions to see same as above
. regress weight mweight if ms_gp==0
```

Source	SS	df	MS	Number of obs =	381
Model	19.9691724	1	19.9691724	F(1, 379) =	18.88
Residual	400.850734	379	1.05765365	Prob > F =	0.0000
Total	420.819907	380	1.10742081	R-squared =	0.0475
				Adj R-squared =	0.0449
				Root MSE =	1.0284

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
mweight	.0126134	.0029028	4.35	0.000	.0069057 .0183211
_cons	6.103133	.3787358	16.11	0.000	5.358447 6.84782

```
. regress weight mweight if ms_gp==1
```

Source	SS	df	MS	Number of obs =	169
Model	10.5295899	1	10.5295899	F(1, 167) =	9.52
Residual	184.61373	167	1.10547144	Prob > F =	0.0024
Total	195.14332	168	1.16156738	R-squared =	0.0540
				Adj R-squared =	0.0483
				Root MSE =	1.0514

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
mweight	.0183229	.0059369	3.09	0.002	.0066018 .0300441
_cons	5.001517	.7237813	6.91	0.000	3.572577 6.430458

```
. regress weight mweight if ms_gp==2
```

Source	SS	df	MS	Number of obs =	130
Model	2.03419408	1	2.03419408	F(1, 128) =	1.72
Residual	151.496879	128	1.18356937	Prob > F =	0.1922
Total	153.531073	129	1.19016336	R-squared =	0.0132
				Adj R-squared =	0.0055
				Root MSE =	1.0879

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
mweight	.006227	.0047498	1.31	0.192	-.0031714 .0156253
_cons	6.471542	.6135801	10.55	0.000	5.257469 7.685615

4. ANCOVA with several covariates

```
. *fit mother's age, height, and gest length in addition to mother's age
. anova weight ms_gp mweight mage mheight gest,cat(ms_gp)
```

Number of obs = 680					
R-squared = 0.2575					
Root MSE = .945452					
Adj R-squared = 0.2509					
Source	Partial SS	df	MS	F	Prob > F
Model	208.614176	6	34.7690293	38.90	0.0000
ms_gp	21.4974642	2	10.7487321	12.02	0.0000
mweight	8.81068556	1	8.81068556	9.86	0.0018
mage	.261046609	1	.261046609	0.29	0.5891
mheight	8.85729309	1	8.85729309	9.91	0.0017
gest	127.058652	1	127.058652	142.14	0.0000
Residual	601.58137	673	.893880194		
Total	810.195546	679	1.19321877		

```
. anova,regress
```

Source	SS	df	MS	Number of obs = 680
Model	208.614176	6	34.7690293	F(6, 673) = 38.90
Residual	601.58137	673	.893880194	Prob > F = 0.0000
Total	810.195546	679	1.19321877	R-squared = 0.2575
				Adj R-squared = 0.2509
				Root MSE = .94545

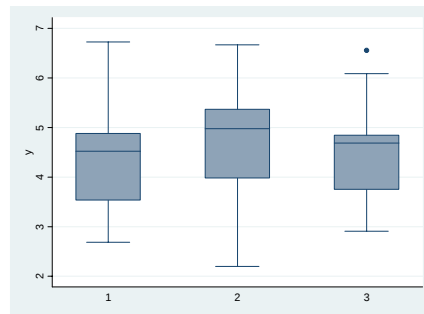
weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_cons	-6.243737	1.242411	-5.03	0.000	-8.683205 -3.804269
ms_gp					
1	.4064518	.0964457	4.21	0.000	.2170811 .5958225
2	.0844867	.1112774	0.76	0.448	-.134006 .3029794
3	(dropped)				
mweight	.0074945	.0023872	3.14	0.002	.0028074 .0121817
mage	-.0036179	.0066949	-0.54	0.589	-.0167633 .0095274
mheight	.0530975	.016868	3.15	0.002	.0199773 .0862177
gest	.2321497	.0194718	11.92	0.000	.1939169 .2703824

```
. lincom(_b[ms_gp[1]]-_b[ms_gp[2]]) /*non- vs. light-smoke contrast*/
```

```
( 1) ms_gp[1] - ms_gp[2] = 0
```

weight	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
(1)	.3219651	.0893562	3.60	0.000	.1465146 .4974156

5. Simulated Data Set 1



```
. anova y group /* ignore covariate */
```

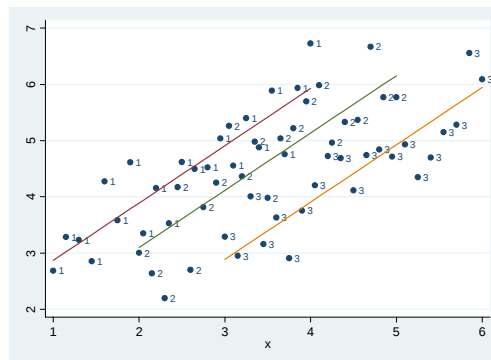
```
Number of obs =      63      R-squared      =  0.0095
Root MSE      =  1.08223    Adj R-squared = -0.0235
```

Source	Partial SS	df	MS	F	Prob > F
Model	.672876396	2	.336438198	0.29	0.7513
group	.672876396	2	.336438198	0.29	0.7513
Residual	70.27336	60	1.17122267		
Total	70.9462364	62	1.14429413		

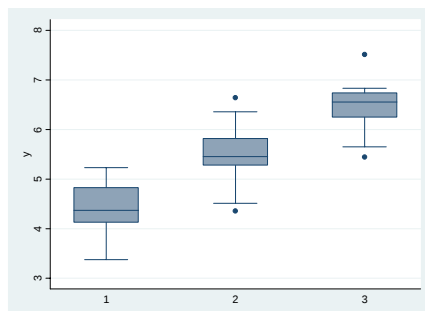
```
. anova y group x,cont(x) /* include covariate */
```

```
Number of obs =      63      R-squared      =  0.7704
Root MSE      =  .525494    Adj R-squared =  0.7587
```

Source	Partial SS	df	MS	F	Prob > F
Model	54.6537313	3	18.2179104	65.97	0.0000
group	24.3554868	2	12.1777434	44.10	0.0000
x	53.9808549	1	53.9808549	195.48	0.0000
Residual	16.2925051	59	.276144154		
Total	70.9462364	62	1.14429413		



6. Simulated Data Set 2



```
. anova y group /* ignore covariate */
```

```
Number of obs =      63      R-squared      = 0.7432
Root MSE      = .492033      Adj R-squared = 0.7347
```

Source	Partial SS	df	MS	F	Prob > F
Model	42.0474144	2	21.0237072	86.84	0.0000
group	42.0474144	2	21.0237072	86.84	0.0000
Residual	14.5257793	60	.242096321		
Total	56.5731936	62	.912470865		

```
. anova y group x,cont(x) /* include covariate */
```

```
Number of obs =      63      R-squared      = 0.7731
Root MSE      = .466398      Adj R-squared = 0.7616
```

Source	Partial SS	df	MS	F	Prob > F
Model	43.7391194	3	14.5797065	67.02	0.0000
group	.883631688	2	.441815844	2.03	0.1403
x	1.69170499	1	1.69170499	7.78	0.0071
Residual	12.8340743	59	.217526682		
Total	56.5731936	62	.912470865		

