

BMI Health Data: Regression ignoring measurement error

```
YesMaster > cat bmihealth.data
44 30.6 25.2 222.7 103 45 28.6 25.1 223 98
59 23.9 15.4 210.4 88 59 25 14.5 231.7 92
39 24.2 17 221.9 129 40 25 22.1 218.4 101
44 30.3 28.8 239.3 112 42 33.3 39.9 224.9 111
44 28.6 20.9 292.1 106 48 23.2 17.1 300.8 71
65 25.4 20.1 242.8 87 63 24 20.7 231.7 85
29 24.9 21.9 255.9 83 37 23.3 9.3 297.2 95
41 23.4 6.3 246.5 107 39 24 9.3 264.3 90
51 28 25.3 265.1 132 56 27.6 25.7 274.3 100
28 23.9 23.5 256.9 66 31 29.1 24 237.7 107
```

Skipping ...

```
45 28.8 29.7 190.2 94 48 30.5 25.5 217 97
30 31.9 26.8 349 65 26 27.4 25.5 322.3 93
30 18.1 13.3 279.4 79 46 15.5 17.5 293.7 88
32 21 8.1 287 76 38 25.7 12.9 276.7 84
36 20.8 7.6 262 63 35 17.3 4.3 249.7 74
34 25.6 11.8 242.3 93 35 25.3 12.4 235.3 93
59 24.4 15.9 280.6 111 50 25.1 19.5 274.5 97
37 19.8 8.8 297.9 98 35 21.5 9.8 278.5 90
52 20.7 17.6 294.1 110 56 22.8 22.5 292.8 115
54 27.3 11.6 137.8 83 51 20.4 13.2 150 84
```

```
/dos/brunner/312f07/bmi > cat bmi1.sas
```

```
/****** bmi1.sas *****/
options linesize=79 noovp formdlim=' ';
title 'BMI and Health: Read data and analyze ignoring measurement error';

data health;
  infile 'bmihealth.data';
  input age1 bmi1 fat1 cholest1 diastol1
         age2 bmi2 fat2 cholest2 diastol2;
  /* fat1 and fat2 are percent body fat */
  age = (age1+age2)/2; bmi = (bmi1+bmi2)/2; fat = (fat1+fat2)/2;
  cholest = (cholest1+cholest2)/2 ; diastol = (diastol1+diastol2)/2;

proc means;
  var age1 -- diastol;
proc reg;
  title2 'Regression on data from measurement set One';
  model cholest1 diastol1 = age1 bmi1 fat1;
proc reg;
  title2 'Regression on data from measurement set Two';
  model cholest2 diastol2 = age2 bmi2 fat2;
proc reg;
  title2 'Regression on average measurements';
  model cholest diastol = age bmi fat;
```

YesMaster > cat bmi1.lst

BMI and Health: Read data and analyze ignoring measurement error 1
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The MEANS Procedure

Variable	N	Mean	Std Dev	Minimum	Maximum
age1	500	43.0880000	13.0125674	2.0000000	83.0000000
bmi1	500	25.4358000	4.5538306	9.8000000	43.0000000
fat1	500	18.7900000	7.7600087	0	50.5000000
cholest1	500	262.0274000	52.5552019	111.2000000	412.4000000
diastol1	500	88.4240000	19.2913591	31.0000000	150.0000000
age2	500	44.4060000	12.4300513	9.0000000	82.0000000
bmi2	500	25.5176000	3.7291908	14.1000000	37.7000000
fat2	500	18.9028000	7.5715394	0	40.7000000
cholest2	500	261.2456000	53.9295529	91.4000000	427.4000000
diastol2	500	88.7000000	13.0992053	51.0000000	127.0000000
age	500	43.7470000	12.4389689	5.5000000	81.0000000
bmi	500	25.4767000	3.8524154	12.4500000	39.4500000
fat	500	18.8464000	7.2364715	0	45.6000000
cholest	500	261.6365000	51.9837358	110.9000000	419.9000000
diastol	500	88.5620000	14.6278537	44.5000000	134.0000000

BMI and Health: Read data and analyze ignoring measurement error 2
Regression on data from measurement set One
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The REG Procedure

Model: MODEL1

Dependent Variable: cholest1

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	59126	19709	7.41	<.0001
Error	496	1319136	2659.54888		
Corrected Total	499	1378263			

Root MSE 51.57081 R-Square 0.0429
Dependent Mean 262.02740 Adj R-Sq 0.0371
Coeff Var 19.68146

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	250.74110	17.03459	14.72	<.0001
age1	1	0.21956	0.18406	1.19	0.2335
bmi1	1	-1.23252	0.85468	-1.44	0.1499
fat1	1	1.76562	0.51160	3.45	0.0006

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 Regression on data from measurement set One
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The REG Procedure

Model: MODEL1

Dependent Variable: diastoll

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	38911	12970	43.83	<.0001
Error	496	146795	295.95731		
Corrected Total	499	185706			

Root MSE 17.20341 R-Square 0.2095
 Dependent Mean 88.42400 Adj R-Sq 0.2048
 Coeff Var 19.45559

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	49.49578	5.68253	8.71	<.0001
age1	1	0.17898	0.06140	2.91	0.0037
bmi1	1	0.75534	0.28511	2.65	0.0083
fat1	1	0.63883	0.17066	3.74	0.0002

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 Regression on data from measurement set Two
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The REG Procedure
 Model: MODEL1
 Dependent Variable: cholest2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	55642	18547	6.59	0.0002
Error	496	1395648	2813.80653		
Corrected Total	499	1451290			

Root MSE 53.04533 R-Square 0.0383
 Dependent Mean 261.24560 Adj R-Sq 0.0325
 Coeff Var 20.30477

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	208.05260	20.52696	10.14	<.0001
age2	1	0.26465	0.20188	1.31	0.1905
bmi2	1	1.05243	0.95346	1.10	0.2702
fat2	1	0.77160	0.48594	1.59	0.1130

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 Regression on data from measurement set Two
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The REG Procedure
 Model: MODEL1
 Dependent Variable: diastol2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	34234	11411	110.14	<.0001
Error	496	51389	103.60664		
Corrected Total	499	85623			

Root MSE 10.17873 R-Square 0.3998
 Dependent Mean 88.70000 Adj R-Sq 0.3962
 Coeff Var 11.47546

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	45.57320	3.93887	11.57	<.0001
age2	1	0.07148	0.03874	1.85	0.0656
bmi2	1	1.14546	0.18296	6.26	<.0001
fat2	1	0.56728	0.09325	6.08	<.0001

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 Regression on average measurements
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The REG Procedure

Model: MODEL1

Dependent Variable: cholest

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	60127	20042	7.72	<.0001
Error	496	1288325	2597.43027		
Corrected Total	499	1348452			

Root MSE 50.96499 R-Square 0.0446
 Dependent Mean 261.63650 Adj R-Sq 0.0388
 Coeff Var 19.47931

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	234.61945	20.59784	11.39	<.0001
age	1	0.20780	0.19418	1.07	0.2851
bmi	1	-0.44239	1.02089	-0.43	0.6650
fat	1	1.54921	0.56153	2.76	0.0060

The REG Procedure
 Model: MODEL1
 Dependent Variable: diastol

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	36726	12242	86.69	<.0001
Error	496	70047	141.22393		
Corrected Total	499	106773			

Root MSE	11.88377	R-Square	0.3440
Dependent Mean	88.56200	Adj R-Sq	0.3400
Coeff Var	13.41859		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	51.67942	4.80290	10.76	<.0001
age	1	0.10321	0.04528	2.28	0.0231
bmi	1	0.66706	0.23805	2.80	0.0053
fat	1	0.81570	0.13094	6.23	<.0001