

SAS Output

- Test of the parallelism hypothesis:

M Matrix Describing Transformed Variables				
	D8	D10	D12	D14
MVAR1	1	-1	0	0
MVAR2	0	1	-1	0
MVAR3	0	0	1	-1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Parallelism Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Parallelism E = Error SS&CP Matrix

S=1 M=0.5 N=10.5					
Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.73988739	2.6953	3	23	0.0696
Pillai's Trace	0.26011261	2.6953	3	23	0.0696
Hotelling-Lawley Trace	0.35155702	2.6953	3	23	0.0696
Roy's Greatest Root	0.35155702	2.6953	3	23	0.0696

- Since there are only two groups, all statistics are equivalent to Hotelling's two-sample T^2

- Test for differences between boys and girls (assuming parallelism):

M Matrix Describing Transformed Variables				
	D8	D10	D12	D14
MVAR1	1	1	1	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Sex (if Parallel) Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Sex (if Parallel) E = Error SS&CP Matrix

S=1 M=-0.5 N=11.5					
Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.72903091	9.2921	1	25	0.0054
Pillai's Trace	0.27096909	9.2921	1	25	0.0054
Hotelling-Lawley Trace	0.37168395	9.2921	1	25	0.0054
Roy's Greatest Root	0.37168395	9.2921	1	25	0.0054

- This result is equivalent to a two-sample t test on the totals (or means) from each subject

SAS Output (Continued)

- Test for differences between boys and girls (without assuming parallelism):

M Matrix Describing Transformed Variables

	D8	D10	D12	D14
MVAR1	1	0	0	0
MVAR2	0	1	0	0
MVAR3	0	0	1	0
MVAR4	0	0	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Sex (Not Parallel) Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Sex (Not Parallel) E = Error SS&CP Matrix

	S=1	M=1	N=10			
Statistic	Value	F	Num DF	Den DF	Pr > F	
Wilks' Lambda	0.60230061	3.6317	4	22	0.0203	
Pillai's Trace	0.39769939	3.6317	4	22	0.0203	
Hotelling-Lawley Trace	0.66030051	3.6317	4	22	0.0203	
Roy's Greatest Root	0.66030051	3.6317	4	22	0.0203	

- Test for differences among time points (assuming parallelism and using equal weights):

M Matrix Describing Transformed Variables

	D8	D10	D12	D14
MVAR1	1	0	0	-1
MVAR2	0	1	0	-1
MVAR3	0	0	1	-1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Time (Parallel) Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Time (Parallel) E = Error SS&CP Matrix

	S=1	M=0.5	N=10.5			
Statistic	Value	F	Num DF	Den DF	Pr > F	
Wilks' Lambda	0.19479424	31.6911	3	23	0.0001	
Pillai's Trace	0.80520576	31.6911	3	23	0.0001	
Hotelling-Lawley Trace	4.13362211	31.6911	3	23	0.0001	
Roy's Greatest Root	4.13362211	31.6911	3	23	0.0001	

SAS Output (Continued)

- Test for differences among time points (assuming parallelism and using weights proportional to sample size):

M Matrix Describing Transformed Variables

	D8	D10	D12	D14
MVAR1	1	0	0	-1
MVAR2	0	1	0	-1
MVAR3	0	0	1	-1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Time (Par., Weights) Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Time (Par., Weights) E = Error SS&CP Matrix

S=1 M=0.5 N=10.5

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.17443309	36.2852	3	23	0.0001
Pillai's Trace	0.82556691	36.2852	3	23	0.0001
Hotelling-Lawley Trace	4.73285734	36.2852	3	23	0.0001
Roy's Greatest Root	4.73285734	36.2852	3	23	0.0001

- Test for differences among time points (without assuming parallelism):

M Matrix Describing Transformed Variables

	D8	D10	D12	D14
MVAR1	1	0	0	-1
MVAR2	0	1	0	-1
MVAR3	0	0	1	-1

Manova Test Criteria and F Approximations for
the Hypothesis of no Overall Time (Not Parallel) Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Time (Not Parallel) E = Error SS&CP Matrix

S=2 M=0 N=10.5

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.16060498	11.4639	6	46	0.0001
Pillai's Trace	0.86220572	6.0623	6	48	0.0001
Hotelling-Lawley Trace	5.08442737	18.6429	6	44	0.0001
Roy's Greatest Root	5.05633791	40.4507	3	24	0.0001

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

NOTE: F Statistic for Wilks' Lambda is exact.

SAS Output (Continued)

- Test for differences among time points in boys:

M Matrix Describing Transformed Variables

	D8	D10	D12	D14
MVAR1	1	0	0	-1
MVAR2	0	1	0	-1
MVAR3	0	0	1	-1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Time (M, Not Parall) Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Time (M, Not Parall) E = Error SS&CP Matrix

S=1 M=0.5 N=10.5

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.19379154	31.8947	3	23	0.0001
Pillai's Trace	0.80620846	31.8947	3	23	0.0001
Hotelling-Lawley Trace	4.16018394	31.8947	3	23	0.0001
Roy's Greatest Root	4.16018394	31.8947	3	23	0.0001

- Test for differences among time points in girls:

M Matrix Describing Transformed Variables

	D8	D10	D12	D14
MVAR1	1	0	0	-1
MVAR2	0	1	0	-1
MVAR3	0	0	1	-1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Time (F, Not Parall) Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Time (F, Not Parall) E = Error SS&CP Matrix

S=1 M=0.5 N=10.5

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.51968477	7.0859	3	23	0.0015
Pillai's Trace	0.48031523	7.0859	3	23	0.0015
Hotelling-Lawley Trace	0.92424343	7.0859	3	23	0.0015
Roy's Greatest Root	0.92424343	7.0859	3	23	0.0015

SAS Output ($q = 4$, Standardized Orthogonal Polynomial Coefficients)

- Is the constant effect of age equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	1	0	0	0

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall INTERCEPT Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.00233639	8113.213	1	19	0.0001
Pillai's Trace	0.99766361	8113.213	1	19	0.0001
Hotelling-Lawley Trace	427.01122311	8113.213	1	19	0.0001
Roy's Greatest Root	427.01122311	8113.213	1	19	0.0001

- Is the linear effect of age equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	1	0	0

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall INTERCEPT Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.26825765	51.8274	1	19	0.0001
Pillai's Trace	0.73174235	51.8274	1	19	0.0001
Hotelling-Lawley Trace	2.72775947	51.8274	1	19	0.0001
Roy's Greatest Root	2.72775947	51.8274	1	19	0.0001

- Is the quadratic effect of age equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	0	1	0

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall INTERCEPT Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.99801735	0.0377	1	19	0.8480
Pillai's Trace	0.00198265	0.0377	1	19	0.8480
Hotelling-Lawley Trace	0.00198659	0.0377	1	19	0.8480
Roy's Greatest Root	0.00198659	0.0377	1	19	0.8480

SAS Output ($q = 4$, Standardized Orthogonal Polynomial Coefficients)

- Is the cubic effect of age equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	0	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall INTERCEPT Effect
on the variables defined by the M Matrix Transformation
H = Type III SS&CP Matrix for INTERCEPT E = Error SS&CP Matrix

S=1 M=-0.5 N=8.5

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.99997328	0.0005	1	19	0.9823
Pillai's Trace	0.00002672	0.0005	1	19	0.9823
Hotelling-Lawley Trace	0.00002672	0.0005	1	19	0.9823
Roy's Greatest Root	0.00002672	0.0005	1	19	0.9823

- Are the nonlinear effects of age simultaneously equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	0	1	0
MVAR2	0	0	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall INTERCEPT Effect
on the variables defined by the M Matrix Transformation
H = Type III SS&CP Matrix for INTERCEPT E = Error SS&CP Matrix

S=1 M=0 N=8

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.99800451	0.0180	2	18	0.9822
Pillai's Trace	0.00199549	0.0180	2	18	0.9822
Hotelling-Lawley Trace	0.00199948	0.0180	2	18	0.9822
Roy's Greatest Root	0.00199948	0.0180	2	18	0.9822

SAS Output ($q = 2, G = I_4$)

General Linear Models Procedure

Dependent Variable: PIO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	22441.65012	22441.65012	208.41	0.0001
Error	19	2045.95238	107.68170		
Uncorrected Total	20	24487.60250			

R-Square	C.V.	Root MSE	PIO Mean
0.000000	30.97837	10.37698	33.49750

Source	DF	Type I SS	Mean Square	F Value	Pr > F
INTERCEPT	1	22441.65012	22441.65012	208.41	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
INTERCEPT	1	22441.65012	22441.65012	208.41	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
INTERCEPT	33.49750000	14.44	0.0001	2.32036316

Dependent Variable: PI1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	71.89632000	71.89632000	51.83	0.0001
Error	19	26.35728000	1.38722526		
Uncorrected Total	20	98.25360000			

R-Square	C.V.	Root MSE	PI1 Mean
0.000000	62.12053	1.177805	1.896000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
INTERCEPT	1	71.89632000	71.89632000	51.83	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
INTERCEPT	1	71.89632000	71.89632000	51.83	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
INTERCEPT	1.896000000	7.20	0.0001	0.26336527

- The model is: Ramus Height = $33.4975 + 1.896 \text{ Age}$

SAS Output ($q = 2, G = S$)

General Linear Models Procedure

Dependent Variable: PS0

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	22297.37042	22297.37042	284.33	0.0001
Error	19	1490.00413	78.42127		
Uncorrected Total	20	23787.37455			

R-Square	C.V.	Root MSE	PS0 Mean
0.000000	26.52193	8.855578	33.38965

Source	DF	Type I SS	Mean Square	F Value	Pr > F
INTERCEPT	1	22297.37042	22297.37042	284.33	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
INTERCEPT	1	22297.37042	22297.37042	284.33	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
INTERCEPT	33.38964691	16.86	0.0001	1.98016754

Dependent Variable: PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	72.69201271	72.69201271	73.12	0.0001
Error	19	18.88861654	0.99413771		
Uncorrected Total	20	91.58062925			

R-Square	C.V.	Root MSE	PS1 Mean
0.000000	52.29919	0.997065	1.906463

Source	DF	Type I SS	Mean Square	F Value	Pr > F
INTERCEPT	1	72.69201271	72.69201271	73.12	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
INTERCEPT	1	72.69201271	72.69201271	73.12	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
INTERCEPT	1.906462860	8.55	0.0001	0.22295041

- The model is: Ramus Height = 33.3896 + 1.906 Age

SAS Output ($q = 4$, Standardized Orthogonal Polynomial Coefficients)

- Are the joint constant effects of age in boys and girls equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	1	0	0	0

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Both Sexes Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.00601330	2066.224	2	25	0.0001
Pillai's Trace	0.99398670	2066.224	2	25	0.0001
Hotelling-Lawley Trace	165.29791169	2066.224	2	25	0.0001
Roy's Greatest Root	165.29791169	2066.224	2	25	0.0001

- Are the joint linear effects of age in boys and girls equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	1	0	0

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Both Sexes Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.19295530	52.2818	2	25	0.0001
Pillai's Trace	0.80704470	52.2818	2	25	0.0001
Hotelling-Lawley Trace	4.18254757	52.2818	2	25	0.0001
Roy's Greatest Root	4.18254757	52.2818	2	25	0.0001

- Are the joint quadratic effects of age in boys and girls equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	0	1	0

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Both Sexes Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.90775401	1.2703	2	25	0.2983
Pillai's Trace	0.09224599	1.2703	2	25	0.2983
Hotelling-Lawley Trace	0.10162003	1.2703	2	25	0.2983
Roy's Greatest Root	0.10162003	1.2703	2	25	0.2983

SAS Output ($q = 4$, Standardized Orthogonal Polynomial Coefficients)

- Are the joint cubic effects of age in boys and girls equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	0	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Both Sexes Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Both Sexes E = Error SS&CP Matrix

S=1 M=0 N=11.5

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.98330640	0.2122	2	25	0.8102
Pillai's Trace	0.01669360	0.2122	2	25	0.8102
Hotelling-Lawley Trace	0.01697701	0.2122	2	25	0.8102
Roy's Greatest Root	0.01697701	0.2122	2	25	0.8102

- Are the nonlinear effects of age in boys and girls simultaneously equal to zero?

M Matrix Describing Transformed Variables

	SOP0	SOP1	SOP2	SOP3
MVAR1	0	0	1	0
MVAR2	0	0	0	1

Manova Test Criteria and F Approximations for
the Hypothesis of no Overall Both Sexes Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Both Sexes E = Error SS&CP Matrix

S=2 M=-0.5 N=11

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.89590891	0.6780	4	48	0.6106
Pillai's Trace	0.10414288	0.6866	4	50	0.6046
Hotelling-Lawley Trace	0.11612709	0.6677	4	46	0.6177
Roy's Greatest Root	0.11562716	1.4453	2	25	0.2547

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

NOTE: F Statistic for Wilks' Lambda is exact.

SAS Output (Covariate-Adjusted Linear Model with Tests of Joint Effects)

General Linear Models Procedure

Dependent Variable: SOP0

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	62488.67539	15622.16885	1004.33	0.0001
Error	23	357.76211	15.55487		
Uncorrected Total	27	62846.43750			

R-Square	C.V.	Root MSE	SOP0 Mean
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0.994307	8.208680	3.943967	48.04630
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NOTE: No intercept term is used: R-square is not corrected for the mean.

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MALE	1	39900.06250	39900.06250	2565.12	0.0001
FEMALE	1	22568.46023	22568.46023	1450.89	0.0001
SOP2	1	0.67977	0.67977	0.04	0.8363
SOP3	1	19.47289	19.47289	1.25	0.2747

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	35692.59704	35692.59704	2294.62	0.0001
FEMALE	1	22579.35173	22579.35173	1451.59	0.0001
SOP2	1	0.92895	0.92895	0.06	0.8091
SOP3	1	19.47289	19.47289	1.25	0.2747

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Both Sexes	2	58712.11974	29356.05987	1887.26	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	49.87425119	47.90	0.0001	1.04116742
FEMALE	45.33076043	38.10	0.0001	1.18979058
SOP2	-0.18896614	-0.24	0.8091	0.77325140
SOP3	-0.55659727	-1.12	0.2747	0.49746113

- The contrast labelled “Both Sexes” tests the null hypothesis that the constant terms for boys and girls are jointly equal to zero

SAS Output (Covariate-Adjusted Linear Model with Tests of Joint Effects)

Dependent Variable: SOP1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	252.5593850	63.1398463	26.85	0.0001
Error	23	54.0781150	2.3512224		
Uncorrected Total	27	306.6375000			

R-Square	C.V.	Root MSE	SOP1 Mean
0.823642	51.93571	1.533370	2.952438

NOTE: No intercept term is used: R-square is not corrected for the mean.

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MALE	1	196.8781250	196.8781250	83.73	0.0001
FEMALE	1	50.5920455	50.5920455	21.52	0.0001
SOP2	1	4.8377981	4.8377981	2.06	0.1649
SOP3	1	0.2514165	0.2514165	0.11	0.7466

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	196.1822754	196.1822754	83.44	0.0001
FEMALE	1	49.8694528	49.8694528	21.21	0.0001
SOP2	1	4.7633791	4.7633791	2.03	0.1681
SOP3	1	0.2514165	0.2514165	0.11	0.7466

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Both Sexes	2	247.5879145	123.7939573	52.65	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	3.697576751	9.13	0.0001	0.40479409
FEMALE	2.130367713	4.61	0.0001	0.46257710
SOP2	-0.427902706	-1.42	0.1681	0.30063138
SOP3	0.063244497	0.33	0.7466	0.19340725

M Matrix Describing Transformed Variables

	SOP0	SOP1
MVAR1	1	0
MVAR2	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Both Sexes Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.00508090	143.3201	4	44	0.0001
Pillai's Trace	1.15284171	15.6496	4	46	0.0001
Hotelling-Lawley Trace	164.73390412	864.8530	4	42	0.0001
Roy's Greatest Root	164.54500978	1892.268	2	23	0.0001

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

NOTE: F Statistic for Wilks' Lambda is exact.

SAS Output (Covariate-Adjusted Linear Model with Tests of Effect Equality)

General Linear Models Procedure

Dependent Variable: SOP0

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	62488.67539	15622.16885	1004.33	0.0001
Error	23	357.76211	15.55487		
Uncorrected Total	27	62846.43750			

R-Square	C.V.	Root MSE	SOP0 Mean
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0.994307	8.208680	3.943967	48.04630
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NOTE: No intercept term is used: R-square is not corrected for the mean.

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MALE	1	39900.06250	39900.06250	2565.12	0.0001
FEMALE	1	22568.46023	22568.46023	1450.89	0.0001
SOP2	1	0.67977	0.67977	0.04	0.8363
SOP3	1	19.47289	19.47289	1.25	0.2747

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	35692.59704	35692.59704	2294.62	0.0001
FEMALE	1	22579.35173	22579.35173	1451.59	0.0001
SOP2	1	0.92895	0.92895	0.06	0.8091
SOP3	1	19.47289	19.47289	1.25	0.2747

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Sex	1	127.4886749	127.4886749	8.20	0.0088

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	49.87425119	47.90	0.0001	1.04116742
FEMALE	45.33076043	38.10	0.0001	1.18979058
SOP2	-0.18896614	-0.24	0.8091	0.77325140
SOP3	-0.55659727	-1.12	0.2747	0.49746113

- The contrast labelled Sex tests the null hypothesis that the constant terms for boys and girls are equal

SAS Output (Covariate-Adjusted Linear Model with Tests of Effect Equality)

Dependent Variable: SOP1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	252.5593850	63.1398463	26.85	0.0001
Error	23	54.0781150	2.3512224		
Uncorrected Total	27	306.6375000			

R-Square	C.V.	Root MSE	SOP1 Mean
0.823642	51.93571	1.533370	2.952438

NOTE: No intercept term is used: R-square is not corrected for the mean.

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MALE	1	196.8781250	196.8781250	83.73	0.0001
FEMALE	1	50.5920455	50.5920455	21.52	0.0001
SOP2	1	4.8377981	4.8377981	2.06	0.1649
SOP3	1	0.2514165	0.2514165	0.11	0.7466

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	196.1822754	196.1822754	83.44	0.0001
FEMALE	1	49.8694528	49.8694528	21.21	0.0001
SOP2	1	4.7633791	4.7633791	2.03	0.1681
SOP3	1	0.2514165	0.2514165	0.11	0.7466

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Sex	1	15.16862320	15.16862320	6.45	0.0183

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	3.697576751	9.13	0.0001	0.40479409
FEMALE	2.130367713	4.61	0.0001	0.46257710
SOP2	-0.427902706	-1.42	0.1681	0.30063138
SOP3	0.063244497	0.33	0.7466	0.19340725

M Matrix Describing Transformed Variables

	SOP0	SOP1
MVAR1	1	0
MVAR2	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Sex Effect
on the variables defined by the M Matrix Transformation
H = Contrast SS&CP Matrix for Sex E = Error SS&CP Matrix

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.63572589	6.3031	2	22	0.0069
Pillai's Trace	0.36427411	6.3031	2	22	0.0069
Hotelling-Lawley Trace	0.57300501	6.3031	2	22	0.0069
Roy's Greatest Root	0.57300501	6.3031	2	22	0.0069

SAS Output (Potthoff-Roy Linear Model with $G = S$)

General Linear Models Procedure

Dependent Variable: SOPSO

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	62402.71113	31201.35557	2180.31	0.0001
Error	25	357.76211	14.31048		
Uncorrected Total	27	62760.47325			

R-Square	C.V.	Root MSE	SOPSO Mean
0.994300	7.877276	3.782920	48.02320

NOTE: No intercept term is used: R-square is not corrected for the mean.

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MALE	1	39799.05489	39799.05489	2781.11	0.0001
FEMALE	1	22603.65624	22603.65624	1579.52	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	39799.05489	39799.05489	2781.11	0.0001
FEMALE	1	22603.65624	22603.65624	1579.52	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	49.87425118	52.74	0.0001	0.94573002
FEMALE	45.33076042	39.74	0.0001	1.14059333

Dependent Variable: SOPS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	268.6763145	134.3381572	62.10	0.0001
Error	25	54.0781151	2.1631246		
Uncorrected Total	27	322.7544296			

R-Square	C.V.	Root MSE	SOPS1 Mean
0.832448	48.07833	1.470756	3.059084

NOTE: No intercept term is used: R-square is not corrected for the mean.

Source	DF	Type I SS	Mean Square	F Value	Pr > F
MALE	1	218.7531819	218.7531819	101.13	0.0001
FEMALE	1	49.9231326	49.9231326	23.08	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	218.7531819	218.7531819	101.13	0.0001
FEMALE	1	49.9231326	49.9231326	23.08	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	3.697576756	10.06	0.0001	0.36768912
FEMALE	2.130367715	4.80	0.0001	0.44344976

SAS Output (Potthoff-Roy Linear Model on Natural Time Scale, $G = S$)

Dependent Variable: PS0

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	7355.728239	3677.864119	243.15	0.0001
Error	25	378.153108	15.126124		
Uncorrected Total	27	7733.881347			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	4015.650102	4015.650102	265.48	0.0001
FEMALE	1	3340.078137	3340.078137	220.82	0.0001

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Both Sexes	2	7355.728239	3677.864119	243.15	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	15.84228933	16.29	0.0001	0.97230796
FEMALE	17.42536849	14.86	0.0001	1.17264752

Dependent Variable: PS1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	13.43381565	6.71690783	62.10	0.0001
Error	25	2.70390575	0.10815623		
Uncorrected Total	27	16.13772140			

Source	DF	Type III SS	Mean Square	F Value	Pr > F
MALE	1	10.93765903	10.93765903	101.13	0.0001
FEMALE	1	2.49615663	2.49615663	23.08	0.0001

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
Both Sexes	2	13.43381565	6.71690783	62.10	0.0001

Parameter	Estimate	T for H0: Parameter=0	Pr > T	Std Error of Estimate
MALE	0.8268032953	10.06	0.0001	0.08221779
FEMALE	0.4763647023	4.80	0.0001	0.09915838

M Matrix Describing Transformed Variables

	PS0	PS1
MVAR1	1	0
MVAR2	0	1

Manova Test Criteria and F Approximations for
the Hypothesis of no Overall Both Sexes Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.00474354	162.2328	4	48	0.0001
Pillai's Trace	1.15982342	17.2556	4	50	0.0001
Hotelling-Lawley Trace	175.12004861	1006.940	4	46	0.0001
Roy's Greatest Root	174.92171510	2186.521	2	25	0.0001

NOTE: F Statistic for Roy's Greatest Root is an upper bound.

NOTE: F Statistic for Wilks' Lambda is exact.

SAS Output (Potthoff-Roy Linear Model on Natural Time Scale, $G = S$)

Tests of Equality of Effects for Boys and Girls

General Linear Models Procedure
Multivariate Analysis of Variance

M Matrix Describing Transformed Variables

	PS0	PS1
MVAR1	1	0

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Sex Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.95858871	1.0800	1	25	0.3086
Pillai's Trace	0.04141129	1.0800	1	25	0.3086
Hotelling-Lawley Trace	0.04320027	1.0800	1	25	0.3086
Roy's Greatest Root	0.04320027	1.0800	1	25	0.3086

M Matrix Describing Transformed Variables

	PS0	PS1
MVAR1	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Sex Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.77156862	7.4015	1	25	0.0117
Pillai's Trace	0.22843138	7.4015	1	25	0.0117
Hotelling-Lawley Trace	0.29606101	7.4015	1	25	0.0117
Roy's Greatest Root	0.29606101	7.4015	1	25	0.0117

M Matrix Describing Transformed Variables

	PS0	PS1
MVAR1	1	0
MVAR2	0	1

Manova Test Criteria and Exact F Statistics for
the Hypothesis of no Overall Sex Effect
on the variables defined by the M Matrix Transformation

Statistic	Value	F	Num DF	Den DF	Pr > F
Wilks' Lambda	0.62312886	7.2577	2	24	0.0034
Pillai's Trace	0.37687114	7.2577	2	24	0.0034
Hotelling-Lawley Trace	0.60480449	7.2577	2	24	0.0034
Roy's Greatest Root	0.60480449	7.2577	2	24	0.0034