The second DESIGN specification requests the regression effect (X) adjusted for the factor DRUG (Figure 1.17e).

Figure 1.17e

TESTS OF SIGNIFICANCE FOR Y USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
WITHIN+RESIDUAL	417.20260	26	16.04625		
CONSTANT	1872.30000	1	1872.30000	116.68144	0.0
DRUG	293.60000	2	146.80000	9.14855	.001
X	577.89740	1	577.89740	36.01447	0.0

The regression coefficient can be obtained from the estimate of the parameters for factor X (Figure 1.17f).

Figure 1.17f

ESTIMATES FOR Y

CONSTANT

PARAMETER	COEFF.	STD. ERR.	T-VALUE	SIG. OF T	LOWER .95 CL	UPPER .95 CL
1	-2.6957729061	1.91108	-1.41060	.170	-6.62406	1.23252

DRUG

PARAMETER	COEFF.	STD. ERR.	T-VALUE	SIG. OF T	LOWER .95 CL	UPPER .95 CL
2	-1.1850365374	1.06082	-1.11709	.274	-3.36559	.99551
3	-1.0760652052	1.04130	-1.03339	.311	-3.21648	1.06435

X

PARAMETER	COEFF.	STD. ERR.	T-VALUE	SIG. OF T	LOWER .95 CL	UPPER .95 CL
4	.9871838111	.16450	6.00121	.000	.64905	1.32531

From the covariance model given above, it follows that there is a common regression coefficient for the given X. This implies that the within-treatment regression coefficients are homogeneous. The assumption of homogeneity of regression coefficients in the analysis of covariance can be assessed by introducing a treatment by covariate interaction term in the model.

A test for no interaction between DRUG effects and covariate is equivalent to testing the hypothesis that the pooled within-treatment regression coefficient is appropriate. The test for treatment by covariate interaction, which is referred to as the test for regression parallelism, can be obtained in MANOVA as follows:

```
MANOVA        Y, X BY DRUG(1,3)/
              ANALYSIS = Y/
              DESIGN = X, DRUG, X BY DRUG/
```

The analysis of variance table for this DESIGN specification is given in Figure 1.17g.

Since X BY DRUG is not significant, the hypothesis of the homogeneity of the within-treatment regression is not rejected.

Figure 1.17g

TESTS OF SIGNIFICANCE FOR Y USING SEQUENTIAL SUMS OF SQUARES

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG. OF F
WITHIN+RESIDUAL	397.55795	24	16.56491		
CONSTANT	1872.30000	1	1872.30000	113.02805	0.0
X	802.94369	1	802.94369	48.47255	0.0
DRUG	68.55371	2	34.27686	2.06924	.148
X BY DRUG	19.64465	2	9.82232	.59296	.561

1.18   Analysis of Covariance with Separate Regression Estimates

Consider a 2 × 2 (Factors A, B) design with covariate X. The model (using dummy variables) can be written as

$$Y_{ijk} = \mu + \beta(X_{ijk} - \bar{X}) + \alpha_I Z_{ijk} + \alpha_g U_{ijk} + \alpha_J Z_{ijk} U_{ijk} + \epsilon_{ijk}$$