```
PROC CANCORR DATA=oil VPREFIX=trans WPREFIX=survey ALL;
VAR ECON CONV LOW DEP;
WITH Q1 Q4 Q6 Q9 Q10 Q13 Q17 Q18 Q19;
RUN;
```

## Canonical Correlation Analysis

|   | Canonical Correlation | Adjusted Canonical Correlation | Approximate Standard Error | Squared Canonical Correlation |
|---|---|---|---|---|
| 1 | 0.298420 | 0.234864 | 0.044717 | 0.089054 |
| 2 | 0.257188 | 0.233348 | 0.045841 | 0.066146 |
| 3 | 0.168392 | . | 0.047696 | 0.028356 |
| 4 | 0.105152 | . | 0.048545 | 0.011057 |

Eigenvalues of Inv(E)*H
= CanRsq/(1-CanRsq)

Test of H0: The canonical correlations in
the current row and all that follow are zero

|   | Eigenvalue | Difference | Proportion | Cumulative | Likelihood Ratio | Approximate F Value | Num DF | Den DF | Pr > F |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.0978 | 0.0269 | 0.4679 | 0.4679 | 0.81742912 | 2.32 | 36 | 1512 | <.0001 |
| 2 | 0.0708 | 0.0416 | 0.3390 | 0.8068 | 0.89734114 | 1.86 | 24 | 1172.3 | 0.0072 |
| 3 | 0.0292 | 0.0180 | 0.1397 | 0.9465 | 0.96090078 | 1.17 | 14 | 810 | 0.2970 |
| 4 | 0.0112 |  | 0.0535 | 1.0000 | 0.98894312 | 0.76 | 6 | 406 | 0.6045 |

### Raw Canonical Coefficients for the VAR Variables

|   | trans1 | trans2 | trans3 | trans4 |
|---|---|---|---|---|
| Econ | -0.029217785 | 0.1832751323 | 0.0045650612 | -0.006968428 |
| Conv | 0.0096489145 | -0.009781367 | 0.0302907922 | 0.1874722991 |
| Low | 0.1527881736 | -0.058046125 | 0.0394490984 | 0.0058874249 |
| Dep | -0.062385453 | -0.021505567 | 0.1316905204 | -0.088846093 |

### Raw Canonical Coefficients for the WITH Variables

|   | survey1 | survey2 | survey3 | survey4 |
|---|---|---|---|---|
| Q1 | 0.0433849191 | 0.6823120946 | -0.187233517 | -0.318970901 |
| Q4 | -0.003174474 | 0.4611789663 | 0.4513863936 | 0.128875721 |
| Q6 | 0.0993631323 | -0.411969742 | 0.621763169 | 0.0338123701 |
| Q9 | 0.3719918012 | -0.093835134 | -0.349406729 | 0.6943242 |
| Q10 | 0.1647529029 | 0.1367768836 | 0.3754045629 | 0.2306414668 |
| Q13 | -0.526848124 | 0.2095364543 | 0.556369226 | 0.4185257049 |
| Q17 | -0.443142773 | -0.032305286 | -0.180397864 | -0.06595099 |
| Q18 | -0.261505236 | 0.0271854046 | -0.288136022 | 0.5375733671 |
| Q19 | -0.172814041 | 0.3243896688 | -0.618365008 | -0.09282767 |

## Canonical Structure

Correlations Between the VAR Variables and Their Canonical Variables

|      | trans1  | trans2  | trans3 | trans4  |
|------|---------|---------|--------|---------|
| Econ | 0.2789  | 0.9200  | 0.2751 | -0.0108 |
| Conv | -0.1634 | -0.0060 | 0.4967 | 0.8524  |
| Low  | 0.9086  | 0.1314  | 0.3832 | -0.1018 |
| Dep  | -0.2671 | -0.0717 | 0.9502 | -0.1435 |

Correlations Between the WITH Variables and Their Canonical Variables

|     | survey1 | survey2 | survey3 | survey4 |
|-----|---------|---------|---------|---------|
| Q1  | 0.1244  | 0.7850  | -0.0898 | -0.1690 |
| Q4  | 0.0399  | 0.6477  | 0.3658  | 0.1906  |
| Q6  | -0.2566 | -0.2374 | 0.3579  | -0.0323 |
| Q9  | 0.5138  | 0.1297  | -0.2794 | 0.6229  |
| Q10 | 0.3877  | 0.0277  | 0.3916  | 0.0876  |
| Q13 | -0.6685 | 0.1687  | 0.2536  | 0.3939  |
| Q17 | -0.5931 | -0.0599 | -0.0499 | -0.1288 |
| Q18 | -0.5055 | 0.0363  | -0.1809 | 0.5866  |
| Q19 | -0.4195 | 0.0463  | -0.2113 | -0.0978 |

The following example concerns the famous "Bumpus sparrow data" that consisted of the following variables:
- length = total length (mm)
- alar = alar extent (mm tip-tip of ext. wings)
- weight = weight (g)
- lbh = length of beak and head (mm)
- lhum = length of humerus (in)
- lfem = length of femur (in)
- ltibio = length of tibiotarsus (in)
- wskull = width of skull (in)
- lkeel = length of keel of sternum (in)

A canonical correlation analysis was performed to see what usefulness the four commonly recorded measurements (the first four) had for predicting the final five measurements that are less commonly recorded. The output on the following page. The output is provided on the following page.

```
PROC CANCORR DATA=bumpus2 VPREFIX=common WPREFIX=uncommon ALL;
VAR length alar weight lbh;
WITH lhum lfem ltibio wskull lkeel;
RUN;
```

                          Canonical Correlation Analysis

|   | Canonical Correlation | Adjusted Canonical Correlation | Approximate Standard Error | Squared Canonical Correlation |
|---|---|---|---|---|
| 1 | 0.683556 | 0.632963 | 0.071836 | 0.467249 |
| 2 | 0.360487 | 0.221495 | 0.117317 | 0.129951 |
| 3 | 0.253491 | 0.203730 | 0.126175 | 0.064258 |
| 4 | 0.108426 | 0.077885 | 0.133255 | 0.011756 |

Eigenvalues of Inv(E)*H
= CanRsq/(1-CanRsq)

Test of H0: The canonical correlations in the current row and all that follow are zero

|   | Eigenvalue | Difference | Proportion | Cumulative | Likelihood Ratio | Approximate F Value | Num DF | Den DF | Pr > F |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.8771 | 0.7277 | 0.7923 | 0.7923 | 0.42863547 | 2.28 | 20 | 156.83 | 0.0025 |
| 2 | 0.1494 | 0.0807 | 0.1349 | 0.9272 | 0.80457057 | 0.91 | 12 | 127.29 | 0.5404 |
| 3 | 0.0687 | 0.0568 | 0.0620 | 0.9893 | 0.92474135 | 0.65 | 6 | 98 | 0.6887 |
| 4 | 0.0119 |  | 0.0107 | 1.0000 | 0.98824374 | 0.30 | 2 | 50 | 0.7440 |

                          Canonical Structure

         Correlations Between the VAR Variables and Their Canonical Variables

|   | common1 | common2 | common3 | common4 |
|---|---|---|---|---|
| length | 0.4928 | -0.6276 | 0.0203 | 0.6024 |
| alar | 0.9160 | 0.1736 | -0.3459 | 0.1055 |
| weight | 0.6223 | 0.0905 | 0.7341 | 0.2562 |
| lbh | -0.2130 | 0.5477 | -0.2239 | 0.7775 |

         Correlations Between the WITH Variables and Their Canonical Variables

|   | uncommon1 | uncommon2 | uncommon3 | uncommon4 |
|---|---|---|---|---|
| lhum | 0.8696 | 0.2619 | -0.3066 | 0.2290 |
| lfem | 0.8789 | -0.1594 | -0.3882 | -0.2202 |
| ltibio | 0.6592 | 0.5155 | 0.0502 | -0.0298 |
| wskull | 0.6117 | -0.5661 | 0.3502 | 0.3669 |
| lkeel | 0.5882 | 0.1403 | 0.5505 | -0.4862 |