Simple Regression with Measurement Error:
With and Without intercepts

```
/* noint.sas */
options linesize=79 noovp formdlim='_';
title 'STA2201s06 Simple Measurement Error Regression';
title2 'Assignment 5 Check: No Intercept';
data ipath;
     infile 'itest.dat.txt';
     input Y X1 X2;

proc calis cov vardef=n;
     var Y X1 X2;
     lineqs
          Y = gamma F + e,
          X1 = F + delta1,
          X2 = F + delta2;
     std                /* Variances (not standard deviations) */
          F = phi,
          e = psi,
          delta1 = theta1,
          delta2 = theta2;
     bounds 0.0 < phi theta1 theta2;


/* measint.sas */
options linesize=79 noovp formdlim='_';
title 'STA2201s06 Simple Measurement Error Regression with Intercept';

data ipath;
     infile 'itest.dat.txt';
     input Y X1 X2;

proc calis ucov aug vardef=n;
          /* ucov and aug together give intercept */
     title2 'Default starting values';
     var Y X1 X2;
     lineqs
          F = kappa intercept + eek,          /* E(F)=kappa */
          Y = alpha intercept + gamma F + e,
          X1 = F + delta1,
          X2 = nu intercept + F + delta2;
     std                /* Variances (not standard deviations) */
          eek = phi,                          /* Var(F)=phi */
          e = psi,
          delta1 = theta1,
          delta2 = theta2;
     bounds 0.0 < phi psi theta1 theta2;
```

```
/* What we want is

         Y = alpha + gamma Kuhsee + zeta
         X1 = Kuhsee + delta1
         x2 = Nu + Kuhsee + delta2
with
         E(Kuhsee)=kappa
         V(Kuhsee)=phi  V(zeta)=psi  V(delta1)=theta1 V(delta2)=theta2

Error terms have to begin with e or d, so we replace zeta with e. Latent
variables must begin with F, so we use F (for Factor) in place of Kuhsee.

Using the options ucov and aug together allow the specification of models with
an intercept. Ucov means fit a model using the "uncorrected" covariance matrix
-- that is, without subtracting off x-bar from the observations. Aug means
"augment" the matrix by adding a variable called "intercept," which has
constant value one. Intercept terms have to be multiplied by this built-in
variable "intercept" -- see above. This is a clever work-around, and not a
desirable syntax for specifying the model. However, we can live with it.

But also, latent variables always have expected value zero by default in proc
calis. This means that in order to make our latent independent variable F have
a non-zero mean, we must explicitly add a constant to it. That's why we say:

          F = kappa intercept + eek

So now E(F) = kappa and V(F) = V(eek), which I called phi. Without this, there
is no kappa at all in the model, and the result is a disaster. Eeek!

*/
```

No-intercept output:

```
Objective Function       0.0002359465

          Manifest Variable Equations with Estimates


            Y       =   1.1964*F        +  1.0000 e
            Std Err     0.3943 gamma
            t Value     3.0341
            X1      =   1.0000 F        +  1.0000 delta1
            X2      =   1.0000 F        +  1.0000 delta2


                   Variances of Exogenous Variables

                                                   Standard
       Variable Parameter      Estimate               Error    t Value

       F        phi             1.22290             0.43289       2.82
       e        psi             2.89575             0.73550       3.94
       delta1   theta1          3.47072             0.55224       6.28
       delta2   theta2          4.41848             0.63665       6.94
```

With-intercept output:

```
Objective Function        0.0002359472

          Manifest Variable Equations with Estimates


Y          =   1.1965*F         + -1.0803*Intercept +  1.0000 e
Std Err        0.3943 gamma        3.8872 alpha
t Value        3.0341             -0.2779
X1         =   1.0000 F         +  1.0000 delta1
X2         =   1.0000 F         + 0.00751*Intercept +  1.0000 delta2
Std Err                            0.2301 nu
t Value                            0.0327
```

```
               Latent Variable Equations with Estimates


          F          =   9.8403*Intercept +  1.0000 eek
          Std Err        0.1775 kappa
          t Value       55.4427


                   Variances of Exogenous Variables

                                                   Standard
      Variable  Parameter      Estimate               Error    t Value

      Intercept                 1.00000
      eek       phi             1.22289             0.43289       2.82
      e         psi             2.89575             0.73551       3.94
      delta1    theta1          3.47082             0.55225       6.28
      delta2    theta2          4.41838             0.63664       6.94
```