# MIX{WILD} 2-Stage Model Cheatsheet

Stage 1

Stage 2

## 2-Stage Model Approach:

MixWILD combines a Stage 1 mixed-effects location-scale (**MELS**) or mixed-effects multiple location scale (**MEMLS**) model with a subsequent Stage 2 regression in which the Stage 1 random effects are used as regressors in the Stage 2 model. Stage 2 outcome can be a subject-level or 2-level outcome.

## [*Model Configuration*]

### 1 Data import

- Import data
- Create title (optional)
- Set up missing value

### 2 Select stage 1 outcome

Select **Continuous**, **Dichotomous**, or **Ordinal** for Stage 1 outcome. Choose between **Probit** or **Logistic** model if your Stage 1 outcome is dichotomous/ordinal.

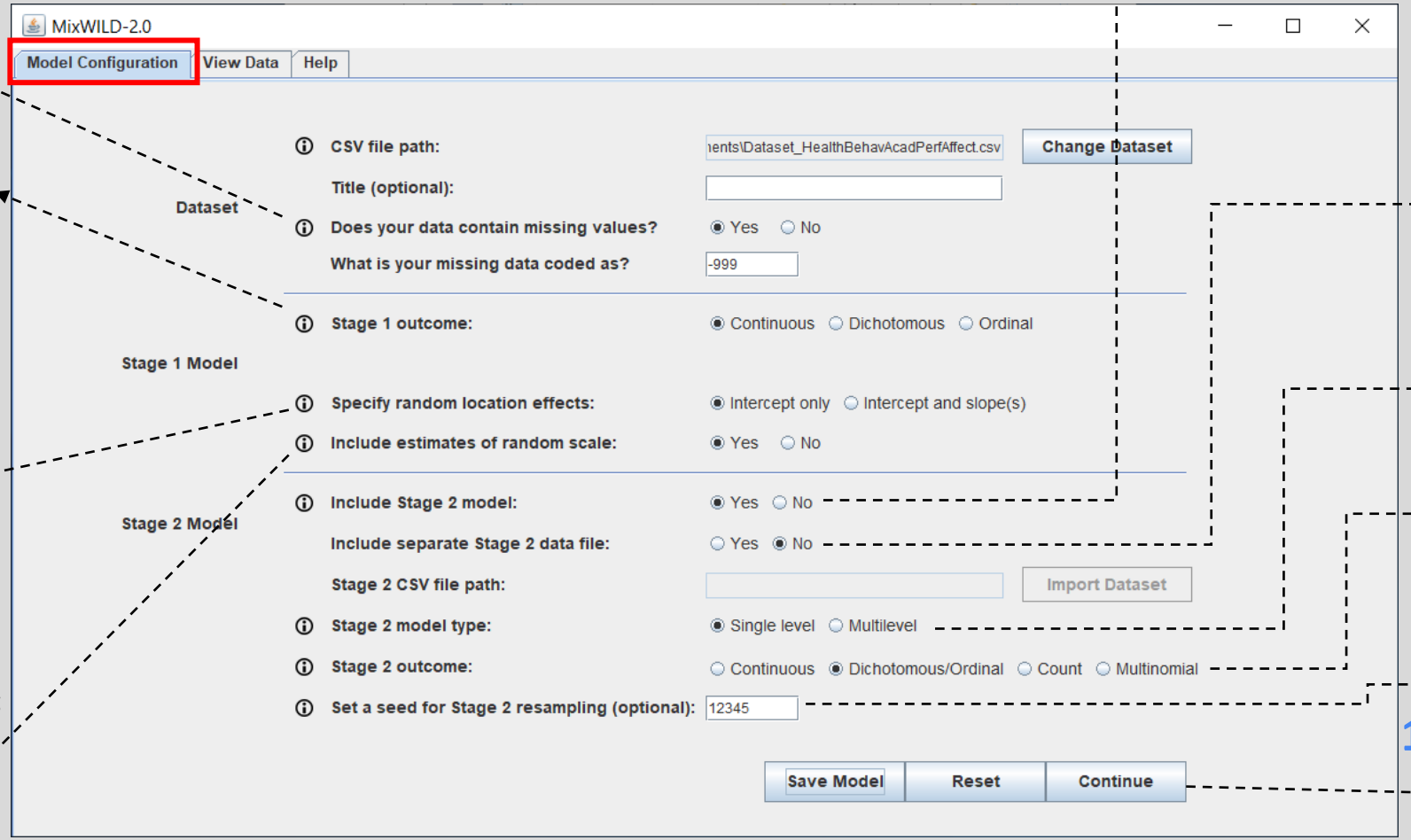
### 3 Specify random location

Select "Intercept only" and the model includes a random subject intercept.
It will become **MELS** when adding a random scale (#4).

Select "Intercept and slope(s)" and the model includes a random subject intercept and random slope(s).
It will become **MEMLS** when adding a random scale (#4).

### 4 Select random scale

Select **"Yes"** if the model includes random subject scale (allowing subjects to have individual within-subject variance effects).




### 5 Select stage 2 model

Select **"Yes"** when you have a stage 2 model.
Select **"No"** when you just need a stage 1 model.

### 6 Select separate stage 2 data

Select **"Yes"** when your stage 2 data file is separate (need **ID** to link with stage 1). **Import Dataset** for stage 2 separate data.

Select **"No"** when your stage 1 & 2 data are saved in the same file.

### 7 Select stage 2 model

The stage-2 outcome can be single- or multilevel.

### 8 Select stage 2 outcome

**Continuous:** BMI or weight;
**Dichotomous:** Yes or No;
**Count:** Times of having snacks per day
**Nominal:** Types of physical activities

### 9 Set a random seed (optional)

Use the same seed for resampling will allow you to get the same result.

### 10 Complete Model Config.:

**Click "Continue":** Click continue to enter Stage 1 Configuration window.
**Click reset (optional):** Reset settings.
**Save model (optional):** Click it to keep all the model configuration settings above and save it as a .MW file.

* Please see more details in User's Guide Chapter 3.

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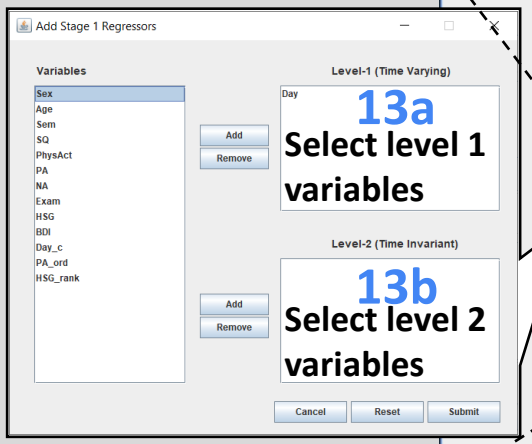
## *[Stage 1 Configuration]*

### 11 Select ID

ID is the key variable to define the two levels of your data.
ID also link data between stage 1 and stage 2 datasets.

### 12 Select Stage 1 Outcome

### 13 Select Stage 1 Regressors

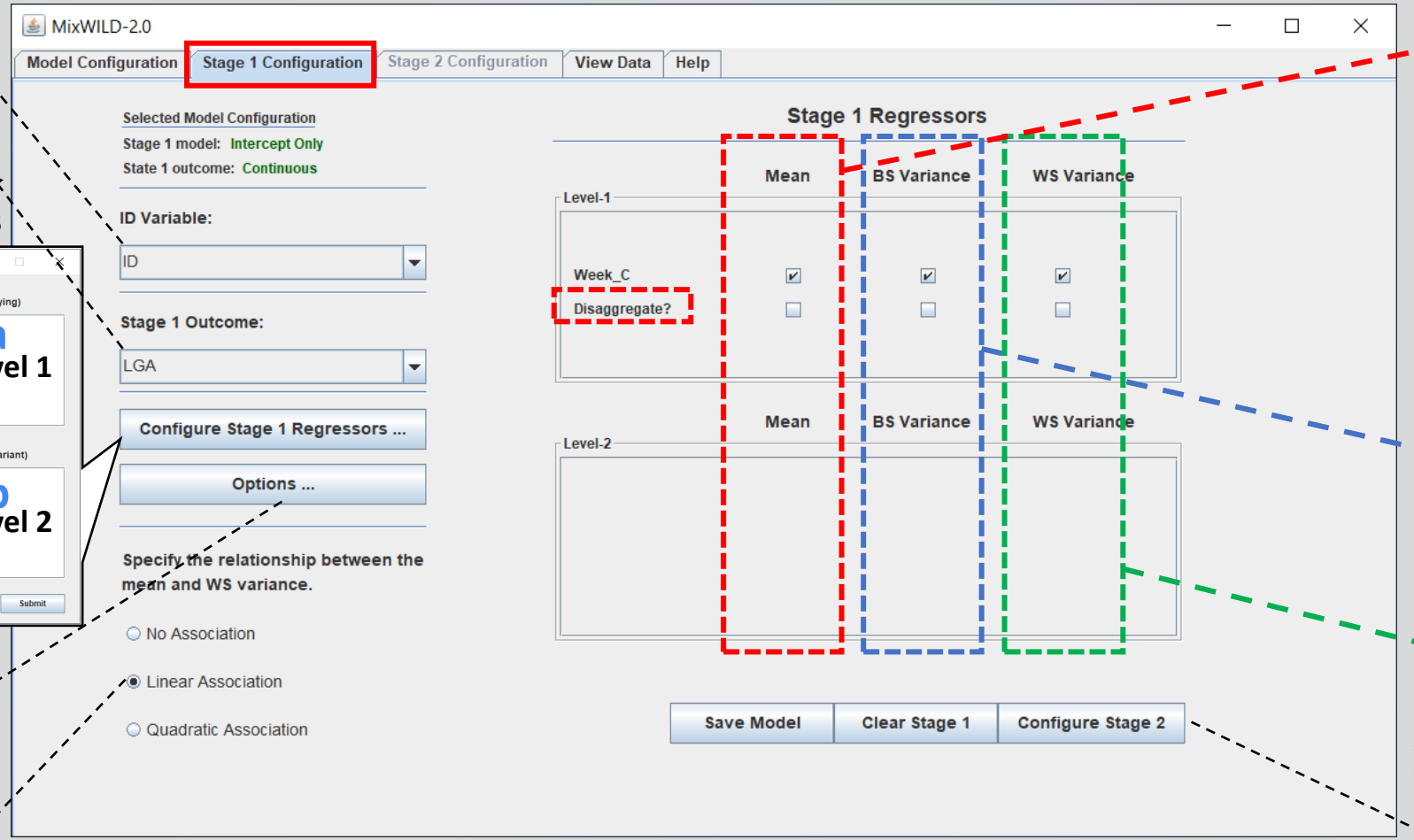



### 14 Stage 1 Options

Please check the details in the [Stage 1 Options] cheatsheet.

### 15 Specify the relationship

Specify the association between mean and within-subject (WS) variance of the outcome variable aka the association of the random intercept and random scale effects.




* Please see more details in User's Guide Chapter 3.

### 16 Specify Mean Model

Select the regressor(s) to predict the mean value of the outcome variable. In the example, the regressor is as follows:
- Week_C

### * Disaggregate

Select "Disaggregate" for each of the time-varying variable(s) for which decomposition of the within-subject and between-subject effects in predicting stage 1 outcome is desired.

### 17 Specify BS Model

Select the regressor(s) to predict the between-subject variance of the outcome variable.
- Week_C

### 18 Specify WS Model

Select the regressor(s) to predict the within-subject variance of the outcome variable.
- Week_C

### 19 Configure Stage 2

**Click "Continue":** Click it to enter Stage 2 Configuration window.
**Save model (optional):** Click it to keep all the model configuration settings above and save it as a .MW file.

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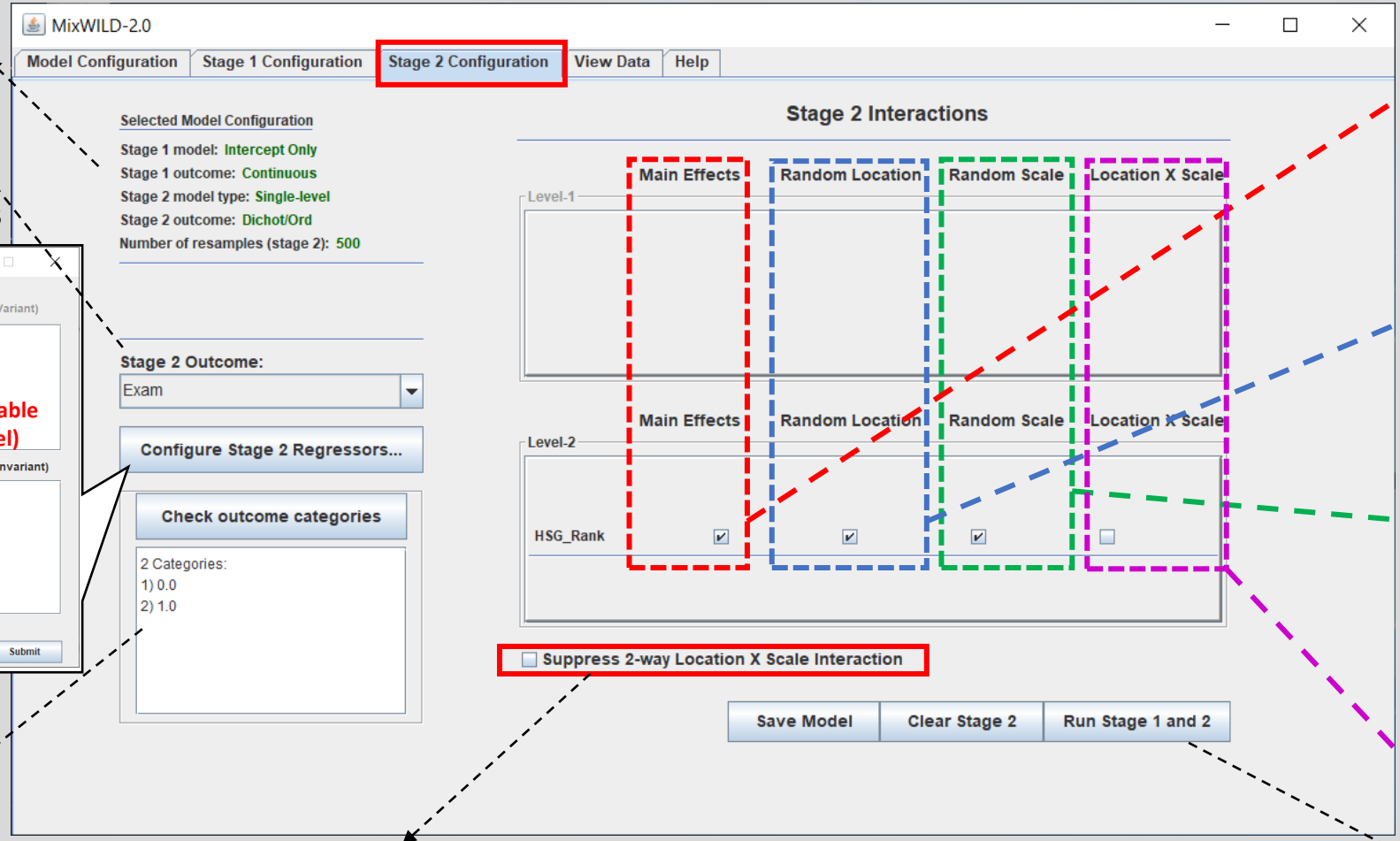
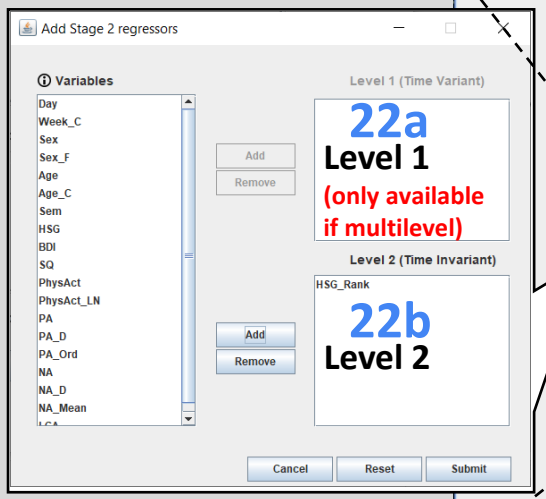
## *[Stage 2 Configuration]*




### 20 Summary of Settings

This section indicates the key selected settings from prior pages.

### 21 Select Stage 2 Outcome

### 22 Select Stage 2 Regressors

### 23 Check (stage 2) outcome categories

The function can check how many categories in the stage 2 outcome variable when the stage 2 outcome is dichotomous/ordinal, or multinominal

### 24 Mean Effects

Check the box(s) of the regressor(s) to add the main effect in the model.
In the example, the regressor is as follows:
- HSG_Rank

### 25 Random Location (x Interaction)

Check the box(s) of the regressor(s) to add the interaction effect by random location (intercept + slope(s)) in the model.
In the example, the regressor is as follows:
- Random Location x HSG_Rank

### 26 Random Scale (x Interaction)

Check the box(s) of the regressor(s) to add the interaction effect by random scale in the model.
In the example, the regressor is as follows:
- Random Scale x HSG_Rank

### 27 Random Location x Scale (x Interaction)

Check the box(s) of the regressor(s) to add the interaction effect by random location and scale in the model.

### 28 Suppress 2-way Location x Scale Interaction

The interaction(s) of location by scale are automatically specified in the default Stage 2 model, but this option can be disabled by checking this box, which limits the model to show the main effects of random effects only.

### 29 Run Stage 1 and 2 model

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## [*Stage 1 Analysis Results*]

### Overview (Example 2 in Users' Guide Chapter 3)

In this analysis, the outcome variable is learning goal achievement (LGA), and we examine whether week elapsed (Week_C) can predict their LGA (continuous, time-varying variable) in the Mean, BS and WS Variance submodels.

### Mean (Beta) Model

This analysis shows that a person's LGA is not significantly related to the week elapsed (*beta=-0.015*).

### BS (Alpha) Model

The intercept estimate shows subject's BS Variance is different from zero on the log scale (*alpha=-0.994*). The BS variance is equal to exp(-0.994) = 0.370. Subjects' LGA means are more varied with increased units of the week elapsed (*alpha=0.096*).

### WS (Tau) Model

The intercept estimate shows subject's WS Variance is different from zero on the log scale (*tau=-0.306*). The WS variance is equal to exp(-0.306) = 0.736. The within-subject variance in LGA decreases for subjects on the day elapsed (*tau=-0.080*).

### Random Scale

A significant random scale standard deviation (Std Dev) suggests that subjects differ from each other in their degree of WS variance in LGA (*scale sd=0.410*).

### Association between Mean and WS Variance

WS variance and mean are not statistically related (*estimate=-0.070*).

**Results from stage 1 analysis**

```
-----------------------
Model WITH RANDOM Scale
-----------------------
 Total  Iterations =  13
 Final Ridge value = 0.0

 Log Likelihood                 =    -2739.260
 Akaike's Information Criterion =    -2747.260
 Schwarz's Bayesian Criterion   =    -2756.366

 ==> multiplied by -2
 Log Likelihood                 =     5478.520
 Akaike's Information Criterion =     5494.520
 Schwarz's Bayesian Criterion   =     5512.733


Variable              Estimate     AsymStdError         z-value         p-value
-----------------    ------------    ------------    ------------    ------------
BETA (regression coefficients)
intercept               2.14526         0.07468        28.72584         0.00000
Week_C                 -0.01501         0.01552        -0.96704         0.33353
ALPHA (BS variance parameters: log-linear model)
intercept              -0.99350         0.17907        -5.54810         0.00000
Week_C                  0.09621         0.04907         1.96067         0.04992
TAU (WS variance parameters: log-linear model)
intercept              -0.30635         0.05911        -5.18293         0.00000
Week_C                 -0.08035         0.02694        -2.98267         0.00286
Random scale standard deviation
Std Dev                 0.40979         0.04889         8.38112         0.00000
Random location (mean) effect on WS variance
Loc  Eff               -0.07005         0.06292        -1.11328         0.26559
```

*** Please see more details in User's Guide Chapter 3 {Example 2}.**

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## [*Stage 2 Analysis Results*]

### Overview (Example 2 in Users' Guide Chapter 3)

In this analysis, it examines whether the random effects (a subject's intercept and scale estimates) from the MELS analysis are associated with a Stage 2 outcome, Exam. In addition, we control for the covariate, high school grades (HSG_Rank) in the model. Since the outcome, Examination success, is subject-level and dichotomous (1 = Pass), a subject-level logistic regression model treating the stage-1 subject-level random effects as regressors will be run.

### Subject-level Logistic Regression Model

This regression analysis indicates that as subject's high school grades increased, their likelihood of passing exam in college is increased (*beta=1.770*). There is no statistical association between random effects (i.e., random location and random scale effects) and examination success. The data also don't support the control variable, high school grades, is moderated by random effects.

### Regressor List:

**Locat_1:** Estimated Random Location Effect
**Locat_1*HSG_Rank:** Interaction between Random Location and High School Grades
**Scale_1:** Estimated Random Scale Effect
**Scale_1*HSG_Rank:** Interaction between Random Scale and High School Grades
**Locat_1*Scale:** Interaction between Random Location and Random Scale

**Results from stage 2 analysis**

```
There are           0 subjects with unestimable random effect values


Number of replications =         499

-------------
Final Results
-------------
Average Log Likelihood         =      -41.764 (sd=       7.331)
Akaike's Information Criterion =      -48.764
Schwarz's Bayesian Criterion   =      -56.732

==> multiplied by -2
Log Likelihood                 =       83.528
Akaike's Information Criterion =       97.528
Schwarz's Bayesian Criterion   =      113.465


Variable               Estimate    AsymStdError         z-value         p-value
----------------    ------------    ------------    ------------    ------------
Intercept               -2.41184         1.00715        -2.39473         0.01663
HSG_Rank                 0.17697         0.07532         2.34952         0.01880
Locat_1                  0.37664         1.05835         0.35588         0.72193
Locat_1*HSG_Rank         0.02781         0.07885         0.35265         0.72435
Scale_1                 -0.33888         1.29026        -0.26265         0.79282
Scale_1*HSG_Rank         0.02712         0.09438         0.28730         0.77389
Locat_1*Scale            0.13744         0.41085         0.33453         0.73798
```

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