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## Lecture 5e: Practice Problem Solutions

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# Arm Circumference: Interaction—Height and Sex

1. The following MLR shows the result of a model relating arm circumference (cm) to height (cm) and sex (1 = female, 0 = male) with an interaction term for height and sex (height\_sex). This again is based on the random sample of 150 Nepali children < 12 months old.

```
. gen height_sex= height*sex
```

```
. regress armcirc height sex height_sex
```

Source	SS	df	MS	Number of obs	=	150
Model	149.792035	3	49.9306782	F( 3, 146)	=	41.34
Residual	176.345897	146	1.20784861	Prob > F	=	0.0000
				R-squared	=	0.4593
				Adj R-squared	=	0.4482
				Root MSE	=	1.099
Total	326.137932	149	2.18884518			

armcirc	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
height	.1675488	.0191759	8.74	0.000	.1296506	.205447
sex	1.260999	1.771483	0.71	0.478	-2.240064	4.762062
height_sex	-.0217193	.0286107	-0.76	0.449	-.0782641	.0348254
_cons	2.141675	1.191448	1.80	0.074	-.2130371	4.496388

## Arm Circumference: Interaction—Height and Sex

1. The following MLR shows the result of a model relating arm circumference (cm) to height (cm) and sex (1 = female, 0 = male) with an interaction term for height and sex. This again is based on the random sample of 150 Nepali children < 12 months old.

- *Notice: the model results can be written in equation form as follows:*

$$\hat{y} = 2.1 + 0.17 \times \text{height} + 1.26 \times \text{sex} + -0.2 \times \text{height} \times \text{sex}$$

- *For males (sex = 0) this becomes:  $\hat{y} = 2.1 + 0.17 \times \text{height}$*
- *For females (sex = 1) this becomes:*

$$\hat{y} = 2.1 + 0.17 \times \text{height} + 1.26 \times 1 + -0.02 \times \text{height} \times 1$$

$$\hat{y} = 3.36 + (0.17 + -0.02) \times \text{height}$$

$$\hat{y} = 3.36 + (0.15) \times \text{height}$$

## Arm Circumference: Interaction—Height and Sex

1. The following MLR shows the result of a model relating arm circumference (cm) to height (cm) and sex (1 = female, 0 = male) with an interaction term for height and sex. This again is based on the random sample of 150 Nepali children < 12 months old.
  - a) What does the model estimate for mean difference in arm circumference between groups of male children who differ by 1 cm in height?
    - ▶ *As per the previous slide, the slope of height for males is 0.17.*
  - b) What does the model estimate for mean difference in arm circumference between groups of female children who differ by 1 cm in height?
    - ▶ *As per the previous slide, the slope of height for females is 0.15.*

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1. The following MLR shows the result of a model relating arm circumference (cm) to height (cm) and sex (1 = female, 0 = male) with an interaction term for height and sex. This again is based on the random sample of 150 Nepali children < 12 months old.
  - c) After accounting for sampling variability, are the slopes of height for male and female children statistically significantly different?

## Arm Circumference: Interaction—Height and Sex

1. The following MLR shows the result of a model relating arm circumference (cm) to height (cm) and sex (1 = female, 0 = male) with an interaction term for height and sex. This again is based on the random sample of 150 Nepali children < 12 months old.
  - Just to show you how you could get Stata to estimate the slope of height for females and give a 95% CI, here is the result of using the “lincom” command on the previous regression results:

```
. lincom height+ height_sex
```

```
( 1) height + height_sex = 0
```

```
-----  
armcirc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]  
-----+-----  
      (1) |   .1458295   .0212335     6.87   0.000     .1038649     .1877942  
-----
```

## Arm Circumference: Interaction—Height and Sex

1. The following MLR shows the result of a model relating arm circumference (cm) to height (cm) and sex (1 = female, 0 = male) with an interaction term for height and sex. This again is based on the random sample of 150 Nepali children < 12 months old.
  - d) Just for fun, suppose sex is coded as 1 for male children, and 0 for female children. Can you determine the following?
    1. What would the slope estimate for height be in an MLR relating arm circumference and height with an interaction between height and sex?
      - ▶ *If the coding of sex were reversed such that sex = 0 for females, the slope of height would now estimate the association between arm circumference and height for females. As such, its value would be 0.15 (0.1458).*



## Arm Circumference: Interaction—Height and Sex

1. The following MLR shows the result of a model relating arm circumference (cm) to height (cm) and sex (1 = female, 0 = male) with an interaction term for height and sex. This again is based on the random sample of 150 Nepali children < 12 months old.
  - d) Just for fun, suppose sex is coded as 1 for male children, and 0 for female children. Can you determine the following?
    2. What would the coefficient estimate for height\_sex be in the same model described in part 1?
      - ▶ *This quantity would now be an estimate of what we add to the slope of height for females to get the slope estimate of height for males. From the prior set of results, we know the slope of height for males was 0.17; for females it was 0.15. The difference in slope estimates is 0.02, which would be the estimate for the coefficient of height\_sex. Notice that this is simply the opposite of the value when we originally coded sex as 1 for females and 0 for males.*