How can I perform hypothesis tests in glm?

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Hypothesis testing is a statistical method used to assess the significance of relationships between variables. In the context of generalized linear models (GLM), hypothesis testing can be performed by first specifying a null hypothesis, which states that there is no relationship between the variables, and an alternative hypothesis, which states that there is a relationship between the variables. This can be done by using various statistical tests such as t-tests, ANOVA, or chi-square tests, depending on the type of data and research question. The results of these tests can then be interpreted to determine the significance of the relationship between the variables. GLM provides a flexible framework for conducting hypothesis tests, making it a valuable tool for analyzing data in various fields including social sciences, medicine, and economics.

How can I perform hypothesis tests in glm? | SPSS FAQ

Sometimes you may want to test hypotheses about the parameters after a linear regression analysis. On this page, we show a couple of examples of how to perform these hypothesis tests using the lmatrix and kmatrix subcommands in the glm procedure. These examples will use data set https://stats.idre.ucla.edu/wp-content/uploads/2016/02/hsb2-2.sav. Let's say that we have run a linear regression model as follows.

```
glm write with female read math
/print=parameter
/design=female read math.
```

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Parameter Estimates

Dependent Variable:writing score

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	11.896	2.863	4.155	.000	6.250	17.542
female	5.443	.935	5.822	.000	3.599	7.287
read	.325	.061	5.355	.000	.205	.445
math	.397	.066	5.986	.000	.267	.528

Written as a regression equation, we have the following:

write = b_0 + b_1* female + b_2*read + b_3*math,
where b_0 = 11.896, b_1 = 5.443, b_2 = .325 and b_3 = .397.

Example 1

Let's say that we want to test if the coefficient for read is equal to
the coefficient for math. The lmatrix subcommand allows us to specify our
hypothesis test in terms of the linear combination of the regression
coefficients. In our case, our null hypothesis is that b_2 = b_3, or
equivalently, b_2-b_3 = 0. This leads to our lmatrix subcommand with 1 following

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the variable read and -1 following the variable math.

```
glm write with female read math
/print=parameter
/design=female read math
/lmatrix = 'math = read' read 1 math -1.
```

Custom Hypothesis Tests

Contrast Results (K Matrix)[a]

Contrast			Dependen... writing score
L1	Contrast Estimate		-.072
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-.072
	Std. Error		.116
	Sig.		.534
	95% Confidence Interval for Difference	Lower Bound	-.301
		Upper Bound	.156

a. Based on the user-specified contrast coefficients (L') matrix: math = read

Test Results

Dependent Variable:writing score

Source	Sum of Squares	df	Mean Square	F	Sig.
Contrast	16.792	1	16.792	.388	.534
Error	8473.526	196	43.232		

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In the output, we see the difference between the two parameters is -.072 =
(.325 - .397), as we expected. What the output also gives

is
the standard error for the difference and the confidence interval. The Test
Results table
shows the F-value and the p-value.

Example 2

Let's say that we want to test if the coefficient for female is equal to 4.2.
In order to do this, we need to use the kmatrix subcommand, because we
are testing if the value is something other than 0. You might want to do
this, if, for example, you had regression coefficients from a previous model and
you wanted to see if they were equal to the coefficients obtained with your
current model. To keep the example simple, we will test only one variable
(female) in this example.

```
glm write with female read math
/print=parameter
/design=female read math
```

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/lmatrix = 'female' female 1

/kmatrix 4.2.

Contrast Results (K Matrix)[a]

Contrast			Dependen... writing score
L1	Contrast Estimate		5.443
	Hypothesized Value		4.200
	Difference (Estimate - Hypothesized)		1.243
	Std. Error		.935
	Sig.		.185
	95% Confidence Interval for Difference	Lower Bound	-.601
		Upper Bound	3.087

a. Based on the user-specified contrast coefficients (L') matrix: female

Test Results

Dependent Variable:writing score

Source	Sum of Squares	df	Mean Square	F	Sig.
Contrast	76.452	1	76.452	1.768	.185
Error	8473.526	196	43.232		

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Example 3

Let's say that we want to test if the coefficient for female is equal to 4.2 and that the coefficient for read is equal to the coefficient for math. This will be a two degree-of-freedom test since there are two hypotheses that we want to test simultaneously. Notice that the values specified

on the kmatrix
subcommand are listed in the same order as the tests listed on the lmatrix
subcommand.

glm write with female read math
/print=parameter
/design=female read math
/lmatrix = 'test' female 1; read 1 math -1
/kmatrix 4.2; 0.

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Contrast Results (K Matrix)[a]

Contrast			Dependen... writing score
L1	Contrast Estimate		5.443
	Hypothesized Value		4.200
	Difference (Estimate - Hypothesized)		1.243
	Std. Error		.935
	Sig.		.185
	95% Confidence Interval for Difference	Lower Bound	-.601
		Upper Bound	3.087
L2	Contrast Estimate		-.072
	Hypothesized Value		.000
	Difference (Estimate - Hypothesized)		-.072
	Std. Error		.116
	Sig.		.534
	95% Confidence Interval for Difference	Lower Bound	-.301
		Upper Bound	.156

a. Based on the user-specified contrast coefficients (L') matrix: test

Test Results

Dependent Variable:writing score

Source	Sum of Squares	df	Mean Square	F	Sig.
Contrast	95.324	2	47.662	1.102	.334
Error	8473.526	196	43.232		

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