More on High School and Beyond

	(Intercept)	Х
(Intercept)	.48271	00183
х	00183	7.0E-006

Covariances of Parameter Estimates

The SE^2 for $\hat{\alpha} + \hat{\beta}x$ (needed for the confidence interval for $\pi(x)$) is

$$\hat{Var}(\hat{\alpha}) + x^2 \hat{Var}(\hat{\beta}) + 2x \hat{Cov}(\hat{\alpha}, \beta).$$

Therefore a $(1 - \alpha) \times 100\%$ confidence interval for $logit(\pi(x))$ is given by

$$logit(\hat{\pi}(x)) \pm z_{\alpha/2} \sqrt{\hat{Var}(\hat{\alpha}) + x^2 \hat{Var}(\hat{\beta}) + 2x \hat{Cov}(\hat{\alpha}, \hat{\beta})}$$

A 95% confidence interval for $logit(\pi(100))$

 $logit(\hat{\pi}(100)) \pm 1.96\sqrt{.48271 + 100^2 0.000007 + 2(100)(-0.00183)}$

From this we can find a confidence interval for the odds(100), or $\pi(100)$ by transforming the bounds.

Model with categorical factors

X = SES (socio economic status, categories: 1 = low, 2 = middle, 3 = high) Y = academic program (no=0, yes=1)The dummies:

Ι	Variable			
1	$d_1 = \left\{ \begin{array}{c} 1\\ 0 \end{array} \right.$	if $X = 1$ otherwise		
2	$d_2 = \left\{ \begin{array}{c} 1\\ 0 \end{array} \right.$	if $X = 2$ otherwise		

The model

$$logit(\pi(x)) = \alpha + \beta_1 d_1 + \beta_2 d_2$$

Dependent Variable: program Model: (Intercept), x

The estimates from SPSS:

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test		
			Lower	Upper	Wald Chi-Square	df	Sig.
(Intercept)	.956	.1754	.612	1.299	29.673	1	.000
[ses=1.00]	-1.725	.2530	-2.221	-1.229	46.488	1	.000
[ses=2.00]	989	.2101	-1.401	577	22.152	1	.000
(ses=3.00) (Scale)	0ª 1 ⁶	14	1	68	12		14

Parameter Estimates

Dependent Variable: y Model: (Intercept), ses

Therefore the estimated model equation is

 $logit(\hat{\pi}(x)) = 0.956 - 1.725d_1 - .989d_2$

The odds for being in an academic program for students with low SES (=1) is $e^{-1.725} = .178$ times the odds for students with high SES (=3).

(odds(1)/odds(3)=.178)

According to the output we can reject H_0 : $\beta_1 = 0$ at significance level of 5% ($\chi_0^2 = 46.49, df = 1$) and conclude that the odds for being in an academic program are significantly different for students with low and high SES.

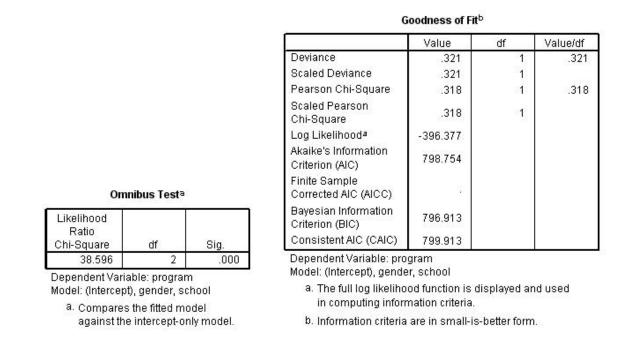
Model with two factors

Again the response will be the variable identifying the program (1=academic, 0 = general or vocational),

The factors considered will be gender (0=female, 1=male) and school type (0=public, 1=private). Because gender and school type are 0/1 variables and therefore already dummy type variables and can be included with the model as coded.

The model:

$$logit(\pi(gender, school)) = \alpha + \beta_1 gender + \beta_2 school$$



The omnibus test indicates that at least one slope is different from 0. At significance level of 5% the data provide sufficient evidence ($\chi_0^2 = 38.569, df = 2, P - value < 0.001$) that either gender or school type or both have an effect on the chance of a student being in an academic program.

The Deviance is reported being 0.321 with df=1 indicating a very good model fit.

The estimates:

Parameter Estimates							
Parameter			95% Profile Likelihood Confidence Interval		Hypothesis Test		
	В	Std. Error	Lower	Upper	Wald Chi- Square	df	Sig.
(Intercept)	191	.1184	424	.041	2.596	1	.107
[gender=1.00]	.070	.1692	261	.402	.173	1	.678
[gender=.00]	0ª	2.	2	22	2	2	29
[school=1.00]	1.533	.2720	1.020	2.092	31.791	1	.000
[school=.00]	0ª	2·		6.	<i></i>		
(Scale)	1 ^b						

Dependent Variable: program Model: (Intercept), gender, school

a. Set to zero because this parameter is redundant.

b. Fixed at the displayed value.

The estimated model equation:

$logit(\hat{\pi}(gender, school)) = -.191 + 0.070gender + 1.533school$

The gender has at significance level of 5% no effect on the chance of a student being in an academic program when controlling for school type ($\chi_0^2 = 0.173, df = 1, P = 0.678$). (At significance level of 5% gender and being in an academic program are conditionally independent (conditioned on the school type)).

But at significance level of 5% the data provide sufficient evidence that the proportion of students in academic programs is different ($\chi_0^2 = 31.79, df = 1, P < 0.001$) in private and public schools, when correcting for gender. Since the slope is positive this indicates that at the proportion for the higher level of school type (which is private schools) is higher than for the lower level (which is public schools).

The odds for being in an academic program are $e^{1.533} = 4.632$ times higher for students in private schools than for students in public schools.

Comment: The model introduced above does not include interaction terms. I.e. the effect of X on Y is the same for all levels of Z and the effect of Z on Y is the same for all levels of X. Thus this model implies homogeneous associations between X and Y given Z and between Z and Y given X.