Re: R^2 and beta coefficients in multiple regression

Source: http://sci.tech−archive.net/Archive/sci.stat.math/2008−09/msg00298.html

* *From*: Ray Koopman <koopman@xxxxxx>
* *Date*: Wed, 24 Sep 2008 00:31:06 −0700 (PDT)

On Sep 23, 9:40 pm, hrun...@xxxxxxxxxx wrote:

> On Sep 23, 11:26 pm, Ray Koopman <koop...@xxxxxx> wrote:
>
> > On Sep 23, 1:29 pm, hrun...@xxxxxxxxxx wrote:
> >
> > > Hi,
> > >
> > > I am trying to work out the relationship between the
> > > magnitude of the
> > > vector of standardized regression coefficients (beta
> > > coefficients) in
> > > a multiple linear regression framework and the coefficient of
> > > determination (R^2) for the same model. Following Bring
> > > (1996; Amer.
> > > Stat. Assoc.), if all variables are standardized, R^2 =
> > > ||y−hat||^2,
> > > and ||y−hat||^2 = B1^2 + B2^2 + ... + Bk^2, where Bk are the
> > > partial
> > > regression coefficients. This implies that the squared
> > > magnitude of
> > > the Beta vector should equal R2. While I can confirm this for
> > > real
> > > data in the case of simple linear regression (one independent
> > > variable), it does not seem to work with multiple independent
> > > variables, so I must be doing something wrong. Any
> > > suggestions would
> > > be much appreciated.
> > >
> > > Best,
> > > Howard
> > >
> > > Assisant Professor
> > > Dept. of Biology, University of Ottawa
> > > Ottawa, ON, Canada
> >
> > When all the variables are standardized, R^2 is guaranteed to equal

> > B1^2 + B2^2 + ... + Bk^2 only when all the predictors are mutually uncorrelated. In general, R^2 = r1*B1 + r2*B2 + ... + rk*Bk, where ri is the correlation of the d.v. with predictor i.

> It was my understanding that when there is multicolinearity, the individual betas become unreliable but the explanatory power of the entire model (i.e. R^2), and hence the sum of the squared Bi's, is not affected. For example, when I rerun the model using the principal components of the original variables in place of the variables (hence, they are mutually uncorrelated), R^2 doesn't change, nor does the sum of the squared Bi's. However, I am left with the problem that one still does not equal the other, and hence I am still confused.

It sounds like the program you're using defines the components as an orthonormal transformation of the data (i.e., a rotation, with possible reflection), without rescaling them to unit variance. Then the sum of squares of the regression weights would be unchanged, even though the components are uncorrelated.
.