A Heteroscedastic Hazards Regression Model with Cure Fraction

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Report

Under the framework of heteroscedastic hazards regression (HHR) model (Hsieh, 2001; Wu, Hsieh, and Wu, 2001), we consider the possibility of existence of "cure fraction", or "nonsusceptibility", with which a complete data full likelihood is derived as well as the associated estimating equations for three components of parameters: the expotent component, the heteroscedasticity component, and the nonsusceptibility component.

Firstly, the complete data full likelihood can be derived as Sy and Taylor (2000);

$$L_C(b, \beta, \gamma, \Lambda_0, y) = \prod_1^n p_i^{y_i}(1 - p_i)^{1-y_i} \prod_1^n \{\lambda_i(t_i|Y = 1, \beta, \gamma, \Lambda_0)\}^{\delta_i Y_i} e^{-y_i \Lambda_i(t_i|Y=1,\beta,\gamma,\Lambda_0)},$$

where δ_i is an indicator of censor-noncensored status, Y_i an indicator of susceptible-nonsusceptible status, and λ_i (or Λ_i) be the hazard (or cumulative hazard) function defined by the HHR model:

$$\Lambda(t_i|Z_{1i}, Z_{2i}, X) = \Lambda_0(t)^{\exp(\gamma Z_2)} \exp(\beta Z_1),$$

and, moreover, $p_i = Pr(Y = 1|X)$ can be further modelled by a set of variable X as

$$p_i = \frac{\exp(b'X)}{1 + \exp(b'X)}.$$

Under rather mild conditions, we derived a set of **estimating equations** for the parameters β, γ, and b, along with the baseline estimate approximated by a **sieve** method.. However, to make our derivation applicable in practice, an **EM-algorithm** is needed to implement the analysis of actual data. We have some satisfactory simulation results (see Table 1 below), which will be presented in more detail in our second-year project (**NSC 90-2118-M-039-001-**) report. Moreover, some actual data anlysis is also pursuited.

References

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Table 1: The expotent and heteroscedasticity components are both taken to be univariate. The logistic regression of the nonsusceptibility component is also univariate, but with intercept. Sample size=100, censoring proportion=25%, with 500 independent replications.

	¯ = 1	° = 0	b_0 =ln(3)=1.0986	b_1 =ln(3)=1.0986
mean	1.0909	-0.0297	1.2572	1.1690
bias	0.0909	-0.0297	0.1586	0.0704
std.err	0.3458	0.3035	0.3154	0.4250
	¯ = 1	° =ln(2)=0.693	b_0 =ln(3)=1.0986	b_1 =ln(3)=1.0986
mean	1.1230	0.7380	1.2045	1.2349
bias	0.1230	0.0450	0.1059	0.1363
std.err	0.2945	0.2228	0.3562	0.3939