Seventh Homework- Survival Analysis

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Criterion	Without Cov	With Cov
-2 LOG L	22153.067	22133.302
AIC	22153.067	22159.302
SBC	22153.067	22230.1

Table 1: Proportional Hazard Model

Criterion	Magnitude
-2 LOG	736.273
AIC	766.273
AICC	766.556
BIC	847.963

Table 3: Accelerated Failiure Time Model (AFT) with Log Normal Distribution

Fit statistics of the PHREG model is presented in table 1. The with covariate model has greater AIC and SBC, so it is worse than intercept only.

Table 2 presents parameter estimate of the model. Only affinity being endorsed rather than not, financial institution affinity, and Time to Cash have effect, with confidence interval of 94%, on duration of account usage.

Table 3 presents the goodness of fit measures of life regression with log normal distribution. Generally this model works better than proportional hazard model, since its AIC and BIC is lower.

Table 4 presents result of estimation of Log Normal AFT. Considering 95% confidence interval only financial institution affinity and Tele Marketing acquisition channel affect duration of card usage.

Table 5 presents the goodness of fit measures of life regression with Weibull distribution. The model

Criterion	Magnitude
-2 Log Likelihood	-549.943
AIC	-519.943
AICC	-519.66
BIC	-438.253

Table 5: Accelerated Failiure Time Model (AFT) with Weibull Distribution

Criterion	Magnitude
-2 LOG	3534.595
AIC	3562.595
AICC	3562.842
BIC	3638.839

Table 7: Accelerated Failiure Time Model (AFT) with Exponential Distribution

works better than Lognormal distribution and proportional hazard model.

Table 6 presents parameters estimates of the AFT model with Weibull distribution. Considering 95% confidence interval only endorsed cards and financial institution cards have significantly different usage duration compared to non endorsed cards.

The goodness of fit measure of the AFT model with exponential distribution is presented in Table 7. Generally the model works only better than the proportional hazard model, among four different models analyzed.

Table 8 presents parameters estimate of AFT with exponential distribution. Considering 95% confidence interval, none of variables is significantly affecting duration of usage of card.

Table 9 presents result of OLS. Considering 95%

Parameter	Estimate	STD ERR	Chi-Sq	Pr> Chi sq	Hazard Ratio
CUR$_C REDIT_L INE$	5.10E-06	3.39E-06	2.2624	0.1325	1
Endorsed	-0.12955	0.06729	3.7064	0.0542	0.878
Financial Inst	-0.19282	0.08752	4.8541	0.0276	0.825
CARD$_C OUNT$	0.05918	0.05574	1.1274	0.2883	1.061
Tele Marketing	-0.15722	0.10759	2.1352	0.144	0.855
Direct Mail	-0.1651	0.10247	2.5957	0.1072	0.848
Direct Promotions	-0.09555	0.11791	0.6566	0.4178	0.909
Platinum Plus	0.07759	0.07087	1.1987	0.2736	1.081
Quantum	0.01576	0.16338	0.0093	0.9231	1.016
Preimum	-0.02457	0.19922	0.0152	0.9019	0.976
TTC	-0.0002853	0.0001274	5.0192	0.0251	1
TTR	7.98E-06	0.0000887	0.0081	0.9283	1
Reward	-0.09157	0.07069	1.678	0.1952	0.912

Table 2: Parmeter Estimate of Proportional Hazard Model

Parameter	Estimate	STD ERR	Chi-Sq	Pr> Chi sq
Intercept	6.7981	0.0415	26784.5	¡.0001
CUR$_C REDIT_L INE$	0	0	1.07	0.3008
Endorsed	0.0337	0.0205	2.7	0.1004
Financial Inst	0.0732	0.0265	7.66	0.0057
CARD$_C OUNT$	-0.0177	0.0158	1.25	0.263
Tele Marketing	0.0551	0.0325	2.88	0.0898
Direct Mail	0.0466	0.0308	2.29	0.1306
Direct Promotions	0.0011	0.0351	0	0.9757
Platinum Plus	-0.0277	0.0209	1.76	0.1841
Quantum	0.027	0.049	0.3	0.5819
Preimum	0.014	0.0593	0.06	0.8128
TTC	0	0	1.36	0.2431
TTR	0	0	1.99	0.1581
Reward	0.0148	0.0217	0.47	0.4941
Scale	0.3	0.0051		

Table 4: Log Normal AFT Estimates

Parameter	Estimate	STD ERR	Chi-Sq	Pr> Chi sq
Intercept	6.9105	0.0225	94051.6	¡.0001
CUR$_C REDIT_L INE$	0	0	1.79	0.1805
Endorsed	0.0199	0.011	3.25	0.0715
Financial Inst	0.0321	0.0143	5.04	0.0248
CARD$_C OUNT$	-0.0051	0.009	0.32	0.5745
Tele Marketing	0.0267	0.0176	2.3	0.1295
Direct Mail	0.0296	0.0167	3.14	0.0764
Direct Promotions	0.0138	0.0191	0.52	0.471
Platinum Plus	-0.0101	0.0115	0.77	0.3802
Quantum	0.0042	0.0266	0.02	0.8756
Preimum	0.0097	0.0324	0.09	0.7644
TTC	0	0	2.34	0.1261
TTR	0	0	0.38	0.5363
Reward	0.0105	0.0116	0.82	0.3644
Scale	0.1631	0.0033		
Weibull Shape	1	6.1313	6.3804	

Table 6: Weibull AFT Estimates

Parameter	Estimate	STD ERR	Chi-Sq	Pr> Chi sq
Intercept	6.8236	0.1382	2437.56	¡.0001
CUR$_C REDIT_L INE$	0	0	0.12	0.7315
Endorsed	0.0349	0.0682	0.26	0.609
Financial Inst	0.0619	0.0881	0.49	0.4825
CARD$_C OUNT$	-0.015	0.0531	0.08	0.778
Tele Marketing	0.05	0.1083	0.21	0.6443
Direct Mail	0.0507	0.1027	0.24	0.6212
Direct Promotions	0.0148	0.117	0.02	0.8991
Platinum Plus	-0.0193	0.0698	0.08	0.7825
Quantum	0.0221	0.1634	0.02	0.8922
Preimum	0.0145	0.1978	0.01	0.9414
TTC	0	0.0001	0.08	0.7812
TTR	0	0.0001	0.08	0.7764
Reward	0.011	0.072	0.02	0.8785
Scale	1	0		
Weibull Shape	0	1	1	

Table 8: Exponential Distribution AFT Estimates

confidence interval, endorsed and finantial institution cards compared with non-endorsed cards, and Tele marketing and Direct marketing acquisition channels compared with internet acquisition channel have significant impact on duration of card usage. These estimates are biased first due to the normality assumption and second due to censoring.

Parameter	Estimate	STD ERR	t-value	Pr> Chi sq
Intercept	918.56345	27.651	33.22	¡.0001
CUR$_{C}REDIT_{L}INE$	-0.00112	0.00069054	-1.62	0.1048
Endorsed	32.91426	13.6512	2.41	0.016
Financial Inst	59.14816	17.62185	3.36	0.0008
CARD$_{C}OUNT$	-13.75106	10.50241	-1.31	0.1906
Tele Marketing	47.33794	21.63987	2.19	0.0288
Direct Mail	47.95649	20.50122	2.34	0.0194
Direct Promotions	14.27435	23.33295	0.61	0.5408
Platinum Plus	-18.27861	13.8812	-1.32	0.1881
Quantum	20.55521	32.65096	0.63	0.5291
Preimum	14.81863	39.47128	0.38	0.7074
TTC	0.03494	0.02596	1.35	0.1785
TTR	0.02581	0.01881	1.37	0.1701
Reward	10.74613	14.43109	0.74	0.4566

Table 9: OLS Estimates