Logit Credit-Risk Modeling

- Write a macro that enables the user to build a logit model through a form. The macro uses Solver to estimate maximum-likelihood model parameters. Results include the coefficients and estimates of default probabilities.

- The user has the choice of adding a constant to the model and of including the following statistics in the results: pseudo-R^2, likelihood ratio and its p-value, log-likelihood of a constant-only model.

Assignment

ID	Year	Default	WC/TA	RE/TA	EBIT/TA	ME/TL	S/TA
1	1999	0	0.501	0.307	0.043	0.956	0.335
1	2000	0	0.55	0.32	0.05	1.06	0.33
1	2001	0	0.45	0.23	0.03	0.80	0.25
1	2002	0	0.31	0.19	0.03	0.39	0.25
1	2003	0	0.45	0.22	0.03	0.79	0.28
1	2004	0	0.46	0.22	0.03	1.29	0.32
2	1999	0	0.01	-0.03	0.01	0.11	0.25
2	2000	0	-0.11	-0.12	0.03	0.15	0.32
2	2001	0	0.06	-0.11	0.04	0.41	0.29
2	2002	0	0.05	-0.09	0.05	0.25	0.34
2	2003	0	0.12	-0.11	0.04	0.46	0.31
3	1999	0	-0.04	0.27	0.05	0.59	0.21
3	2000	0	-0.04	0.25	0.03	0.33	0.21
3	2001	0	0.00	0.15	0.00	0.16	0.16
3	2002	0	-0.05	0.02	0.01	0.07	0.16
3	2003	0	-0.03	-0.01	0.02	0.10	0.18
3	2004	0	-0.03	-0.04	0.02	0.09	0.19
4	1995	0	0.02	0.05	0.05	0.55	0.07
4	1996	0	0.02	0.08	0.03	0.60	0.09
4	1997	0	0.03	0.11	0.04	0.79	0.10
4	1998	0	0.00	0.12	0.04	0.82	0.09
4	1999	0	0.04	0.14	0.02	0.63	0.12
4	2000	0	-0.05	0.15	0.04	0.89	0.15
4	2001	0	-0.01	0.14	0.04	0.68	0.11
4	2002	0	0.00	0.15	0.03	0.58	0.09
4	2003	0	0.01	0.15	0.04	0.58	0.11
4	2004	0	-0.01	0.16	0.05	0.62	0.11
5	1999	0	0.15	0.42	0.10	7.96	0.27
5	2000	0	0.23	0.47	0.09	11.17	0.27
5	2001	0	0.05	0.32	0.08	6.12	0.21
5	2002		0.12	0.36	0.07	4.63	0.22

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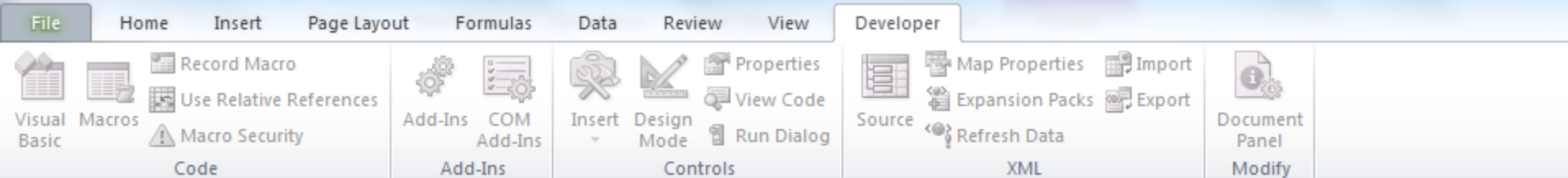Visual Basic | Macros | Record Macro | Use Relative References | Macro Security | Add-Ins | COM Add-Ins | Insert | Design Mode | Properties | View Code | Run Dialog | Source | Map Properties | Expansion Packs | Refresh Data | Import | Export | Document Panel

Code | Add-Ins | Controls | XML | Modify

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Logit Credit Risk

Y Range: T2_T5!$C$1:$C$4001

X Range: T2_T5!$D$1:$H$4001

Output Range: T2_T5!$I$1

☑ Label   ☑ Constant   ☑ Stats

OK

	A	B	C	D	E	F	G	H
1	ID	Year	Default	WC/TA	RE/TA	EBIT/TA	ME/TL	S/TA
2	1	1999	0	0.501	0.307	0.043	0.956	0.335
3	1	2000	0	0.55	0.32	0.05	1.06	0.33
4	1	2001	0	0.45	0.23	0.03	0.80	0.25
5	1	2002	0	0.31	0.19	0.03	0.39	0.25
6	1	2003	0	0.45	0.22	0.03	0.79	0.28
7	1	2004	0	0.46	0.22	0.03	1.29	0.32
8	2	1999	0	0.01	-0.03	0.01	0.11	0.25
9	2	2000	0	-0.11	-0.12	0.03	0.15	0.32
10	2	2001	0	0.06	-0.11	0.04	0.41	0.29
11	2	2002	0	0.05	-0.09	0.05	0.25	0.34
12	2	2003	0	0.12	-0.11	0.04	0.46	0.31
13	3	1999	0	-0.04	0.27	0.05	0.59	0.21
14	3	2000	0	-0.04	0.25	0.03	0.33	0.21
15	3	2001	0	0.00	0.15	0.00	0.16	0.16
16	3	2002	0	-0.05	0.02	0.01	0.07	0.16
17	3	2003	0	-0.03	-0.01	0.02	0.10	0.18
18	3	2004	0	-0.03	-0.04	0.02	0.09	0.19
19	4	1995	0	0.02	0.05	0.05	0.55	0.07
20	4	1996	0	0.02	0.08	0.03	0.60	0.09
21	4	1997	0	0.03	0.11	0.04	0.79	0.10
22	4	1998	0	0.00	0.12	0.04	0.82	0.09
23	4	1999	0	0.04	0.14	0.02	0.63	0.12
24	4	2000	0	-0.05	0.15	0.04	0.89	0.15
25	4	2001	0	-0.01	0.14	0.04	0.68	0.11
26	4	2002	0	0.00	0.15	0.03	0.58	0.09
27	4	2003	0	0.01	0.15	0.04	0.58	0.11
28	4	2004	0	-0.01	0.16	0.05	0.62	0.11
29	5	1999	0	0.15	0.42	0.10	7.96	0.27
30	5	2000	0	0.23	0.47	0.09	11.17	0.27
31	5	2001	0	0.05	0.32	0.08	6.12	0.21
32	5	2002	0	0.12	0.36	0.07	4.63	0.22

Formula bar:

`=IF(ISERROR($C$3*LN(1/(1+IF(ISERROR(EXP(-($K$2+SUMPRODUCT($L$2:$P$2,$D$3:$H$3)))),EXP(709),EXP(-($K$2+SUMPRODUCT($L$2:$P$2,$D$3:$H$3)))))))+`

D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
WC/TA	RE/TA	EBIT/TA	ME/TL	S/TA	LnL	Sum LnL	Constant	WC/TA	RE/TA	EBIT/TA	ME/TL	S/TA		Default probabilit
0.501	0.307	0.043	0.956	0.335	-0.01166	-280.526	-2.54348	0.414394	-1.454023	-7.99906	-1.59359	0.619723		0.011595
0.55	0.32	0.05	1.06	0.33	-0.00916									0.009114
0.45	0.23	0.03	0.80	0.25	-0.01766		Pseudo-R	LR Stat		LR p-value	LnL0			0.017504
0.31	0.19	0.03	0.39	0.25	-0.03297		0.22206	160.148		9.2E-33	-360.6			0.032436
0.45	0.22	0.03	0.79	0.28	-0.01771									0.017556
0.46	0.22	0.03	1.29	0.32	-0.00828									0.008245
0.01	-0.03	0.01	0.11	0.25	-0.07364									0.070996
-0.11	-0.12	0.03	0.15	0.32	-0.06452									0.062479
0.06	-0.11	0.04	0.41	0.29	-0.04176									0.040904
0.05	-0.09	0.05	0.25	0.34	-0.05097									0.049689
0.12	-0.11	0.04	0.46	0.31	-0.04151									0.040661
-0.04	0.27	0.05	0.59	0.21	-0.01597									0.015842
-0.04	0.25	0.03	0.33	0.21	-0.02774									0.02736
0.00	0.15	0.00	0.16	0.16	-0.05361									0.052195
-0.05	0.02	0.01	0.07	0.16	-0.06678									0.064602
-0.03	-0.01	0.02	0.10	0.18	-0.06007									0.058305
-0.03	-0.04	0.02	0.09	0.19	-0.06769									0.065448
0.02	0.05	0.05	0.55	0.07	-0.02171									0.021474
0.02	0.08	0.03	0.60	0.09	-0.02154									0.02131
0.03	0.11	0.04	0.79	0.10	-0.01434									0.014236
0.00	0.12	0.04	0.82	0.09	-0.01399									0.013893
0.04	0.14	0.02	0.63	0.12	-0.02094									0.020726
-0.05	0.15	0.04	0.89	0.15	-0.01171									0.011644
-0.01	0.14	0.04	0.68	0.11	-0.017									0.016855
0.00	0.15	0.03	0.58	0.09	-0.02021									0.020003
0.01	0.15	0.04	0.58	0.11	-0.0192									0.019016
-0.01	0.16	0.05	0.62	0.11	-0.01684									0.016698
0.15	0.42	0.10	7.96	0.27	-7.7E-08									7.68E-08
0.23	0.47	0.09	11.17	0.27	-4.6E-10									4.63E-10
0.05	0.32	0.08	6.12	0.21	-1.7E-06									1.72E-06
0.12	0.36	0.07	4.63	0.22	-1.9E-05									1.94E-05

- One row = one observation
- Each observation i has a default variable y_i which equals 1 if the firm is in default, 0 otherwise.
- Each observation i has a row vector x_i of values for the Altman variables.

Log-Likelihood

- b is the row vector of coefficients, which may include a constant.
- The probability of default for i, $P(y_i = 1)$, is:
  - $p_i = 1/(1+\exp(-b'x_i))$
  - $b'x_i$ is the sumproduct of b and x_i

Log-Likelihood

- The probability of non-default for i, $P(y_i = 0)$, is $1 - p_i$
- Therefore, the probability or likelihood of observing a particular value of y_i is
  - $p_i{}^{y_i} (1 - p_i)^{(1 - y_i)}$

Log-Likelihood

- The log of that likelihood is:
  - $Lnl_i = y_i \ln(p_i) + (1 - y_i)\ln(1 - p_i)$
- Solver finds the value of b that maximizes the sum Lnl of log-likelihoods across all observations.

Log-Likelihood

- If b is only one constant, Lnl becomes:
    - LnL0 = N * (ybar * Ln(ybar)
            + (1 - ybar) * Ln(1 - ybar))
    - ybar is the average of y_i across all observations
    - N is the number of observations

Log-Likelihood

- Pseudo $R^2 = 1 - Lnl/Lnl0$
- Likelihood ratio LR is $2(Lnl - Lnl0)$
- P-value is Chisq.Dist.Rt(LR)

Statistics