Designated Market Makers – Binary Choice Regressions

November 24, 2021

1 Binary Choice Estimation

Look at using R to calculate some results in Skjeltorp and Ødegaard (2015).

In the paper we investigate decisions by firms to hire a Designated Market Maker, a financial market participant that guarantees a minimum liquidity in the firm's stock, against a fee. This decision is a binary choice, either the firm hires a liquidity provider, or not. We investigate what determines this decision.

Going into the reasoning for the possible determinants is not necessary for our purposes, let us just list the possible determinants.

- Constant
- Liquidity (Relative Spread)
- Q
- Sales Growth
- Dummy for whether the firm has a repurchase program
- Dummy for whether the firm has been listed for less than 2 years.

We estimate a probit model where these are possible explantory variables.

Let us look at the way this is estimated in R.

First, the data. It has been dumped into a csv file such as:

```
secid,year,HireDMMThisYear,HaveDMMThisYear,TobinsQ,lnOpIncome,FracLargestOwner,SalesGrowth,RepurchaseLater,AnnouncedRepurchase,IssueEquityLater,InsiderSells,InsiderF
6001,2005,false,false,1.66207,13.5709,0.31858,0.06701,1,1,0,1,0.03349,0.0762903,0.16996,0,0.0891234,-0.168996,,
6006,2005,false,false,1.70654,11.7577,0.1972,-0.05269,1,0,0,0,0.00401,0.0335354,0.375494,0,0.133597,-0.56822,0.35186,0.10352
6026,2005,true,true,1.60246,12.8338,0.40392,0.166596,1,1,0,5,0.02021,0.024252,0.960784,0,0.0295194,0.282457,0.24782,0.19274
```

Reading the data

```
data <- read.table("../data/data_excluding_already_using_dmm.csv",
                   sep=",",header=TRUE,row.names=NULL)
```

To work with the data, let us name the various data series

```
hireDMM <- data$HireDMMThisYear=="true"
FracYearTrading <- data$FracTradingDays
RelSpread <- data$RelSpread
Q <- data$TobinsQ
SG <- data$SalesGrowth
AnnRepu <- data$AnnouncedRepurchase
NewListing<-data$ListingPeriod
```

Let us now do the probit regression.

The call to the routine is:

```
reg1 <- glm(hireDMM~RelSpread + Q+AnnRepu+NewListing,
            subset=(FracYearTrading<0.90),
            family=binomial(link="probit"))
```

A few comments here: probit is a choice under the `glm()` routine. The routine call looks very much like the usual linear regression (`lm()`), but estimation*is* done by Maximum Likelihood.

One feature of the call here: We use only a subset of the data here, we only use stocks that has been traded less than 90% of the year, which is specified by `subset=(FracYearTrading<0.90)`.

The results are then shown as

```
> summary(reg1)

Call:
glm(formula = hireDMM ~ RelSpread + Q + AnnRepu + NewListing,
    family = binomial(link = "probit"), subset = (FracYearTrading <
        0.9))

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.1069  -0.4619  -0.3923  -0.3528   2.4778

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) -1.44319    0.20188  -7.149 8.76e-13 ***
RelSpread   -2.55584    2.71963  -0.940  0.34733
Q            0.20851    0.06060   3.441  0.00058 ***
AnnRepu      0.05871    0.20846   0.282  0.77824
NewListing   0.19375    0.17551   1.104  0.26963
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 312.29  on 480  degrees of freedom
Residual deviance: 296.12  on 476  degrees of freedom
  (239 observations deleted due to missingness)
AIC: 306.12

Number of Fisher Scoring iterations: 5
```

When presenting the data, we usually present the regressions in a more presentable table, as follows:

	Dependent variable:			
	Hire DMM			
	(1)	(2)	(3)	(4)
Liquidity (Rel.Spread)	−2.56	−11.78***		
	(2.72)	(4.12)		
Q	0.21***		0.21***	0.22***
	(0.06)		(0.06)	(0.06)
Sales Growth		0.03		
		(0.14)		
Repurchase Program	0.06	0.09	0.07	0.06
	(0.21)	(0.25)	(0.21)	(0.21)
Listed < 2 years	0.19	0.09	0.25	
	(0.18)	(0.25)	(0.17)	
Constant	−1.44***	−0.75***	−1.62***	−1.56***
	(0.20)	(0.26)	(0.12)	(0.11)
Observations	481	322	510	510
Log Likelihood	−148.06	−89.67	−155.34	−156.45
Akaike Inf. Crit.	306.12	189.34	318.69	318.89
Note:	*p<0.1; **p<0.05; ***p<0.01			

What is the R code that generates this?

```
reg1 <- glm(hireDMM~RelSpread + Q+AnnRepu+NewListing,
            subset=(FracYearTrading<0.90), family=binomial(link="probit"))
reg2 <- glm(hireDMM~RelSpread+SG+AnnRepu+NewListing,
            subset=(FracYearTrading<0.90),
            family=binomial(link="probit"))
reg3 <- glm(hireDMM~ Q+AnnRepu+NewListing,
            subset=(FracYearTrading<0.90),
            family=binomial(link="probit"))
reg4 <- glm(hireDMM~Q+AnnRepu,
            subset=(FracYearTrading<0.90),
            family=binomial(link="probit"))
depvarlbls <- c("Hire DMM","Hire DMM","Hire DMM","Hire DMM")
labls <- c("Liquidity (Rel.Spread)","Q","Sales Growth",
           "Repurchase Program","Listed $<$ 2 years")
tabl1 <- stargazer(reg1,reg2,reg3,reg4,digits=2,
                   title="Ex ante, Dependent variable hire DMM",
                   covariate.labels = labls,
                   float=FALSE,
                   dep.var.labels=depvarlbls)
cat(tabl1,file="../R_tables/hire_dmm_ex_ante_variables_90.tex",sep="\n")
```

References

Johannes Skjeltorp and Bernt Arne Ødegaard. Why do listed firms pay for market making in their own stock? *Financial Management*, pages 241–261, Summer 2015.