Beta_Regression

Library Import

```
library(betareg)
library(caret)
```

Data Preparation

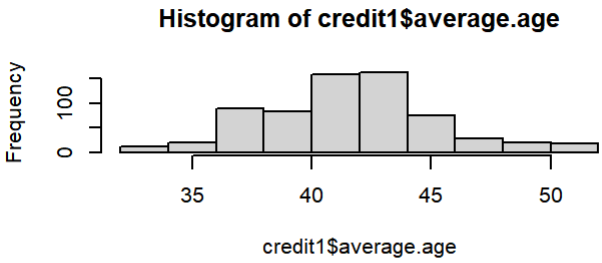
```
credit1 <- read.csv('C:/Users/user/Desktop/wadada/data/CREDIT_CLASS_1_CLUSTER.csv')
```

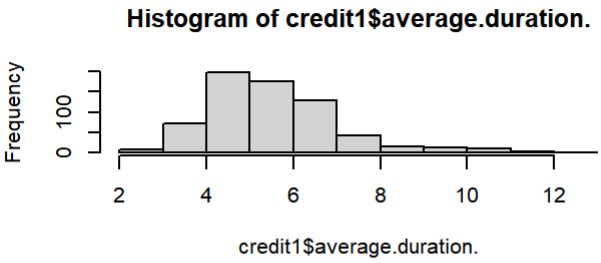
```
colnames(credit1)
```

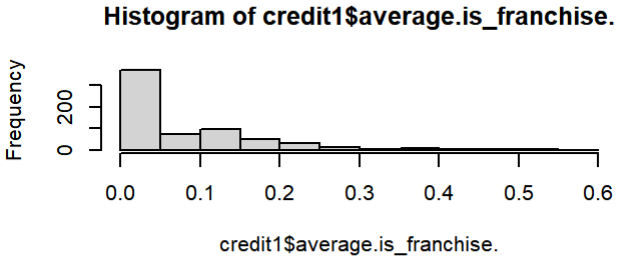
```
##  [1] "trdar_nm"                          "year"
##  [3] "quarter"                           "class_1_name"
##  [5] "average.age."                      "average.duration."
##  [7] "average.is_franchise."             "average.business_square_size."
##  [9] "average.is_risky."                 "average.monthly_rental_fee."
## [11] "average.regular_employees_count."  "average.rental_deposit."
## [13] "average.sum_customer_cnt."         "average.sum_new_customer_cnt."
## [15] "average.sum_purchase_card."        "average.sum_purchase_cash."
## [17] "average.sum_purchase_invoice."     "average.sum_sales_card."
## [19] "average.sum_sales_delivery."       "average.sum_sales_invoice."
## [21] "average.sum_weekend_sales_card."   "average.sum_weekend_sales_delivery."
## [23] "cluster"
```

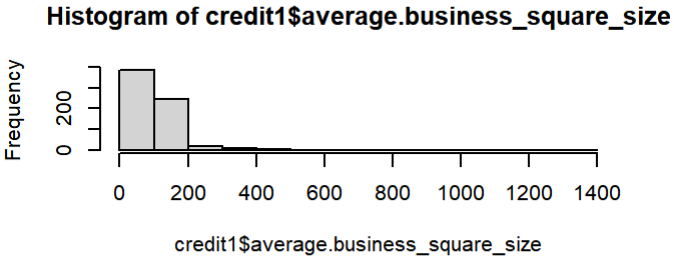
Check distributions of variables

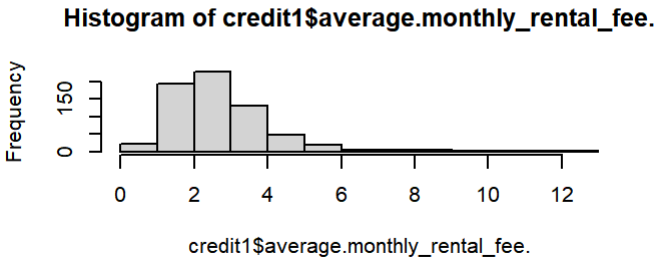
```
par(mfrow = c(3, 2))
hist(x=credit1$average.age)
hist(x=credit1$average.duration.)
hist(x=credit1$average.is_franchise.)
hist(x=credit1$average.business_square_size)
hist(x=credit1$average.monthly_rental_fee.)
hist(x=credit1$average.regular_employees_count.)
```

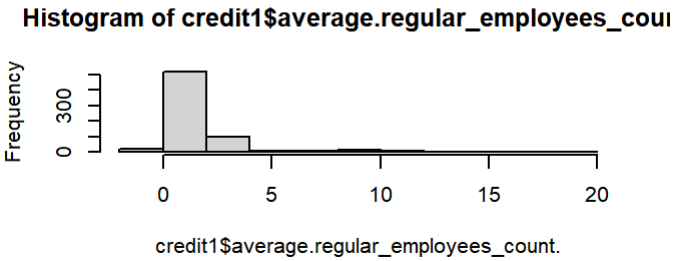




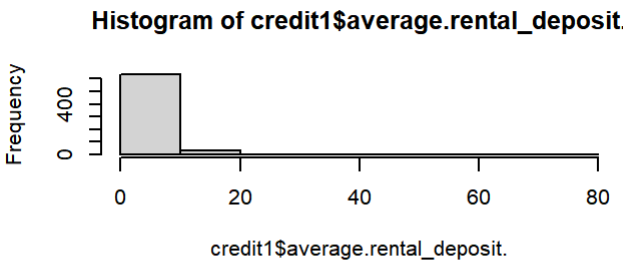


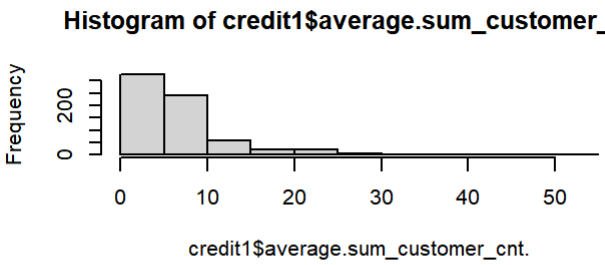


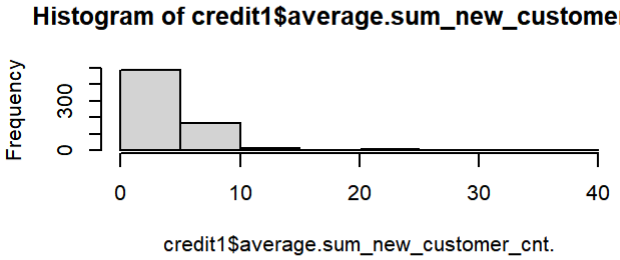


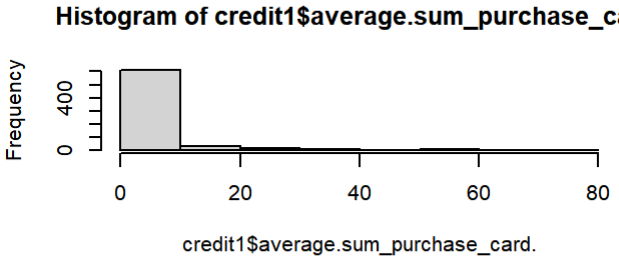


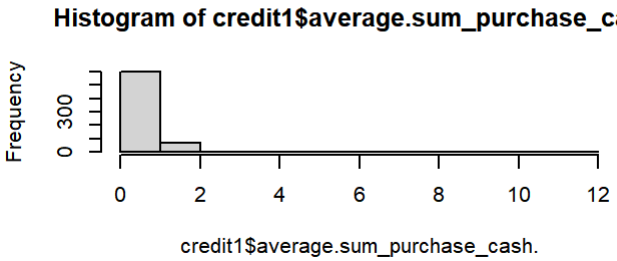

```
par(mfrow = c(3, 2))
hist(x=credit1$average.rental_deposit.)
hist(x=credit1$average.sum_customer_cnt.)
hist(x=credit1$average.sum_new_customer_cnt.)
hist(x=credit1$average.sum_purchase_card.)
hist(x=credit1$average.sum_purchase_cash.)
hist(x=credit1$average.sum_purchase_invoice.)
```

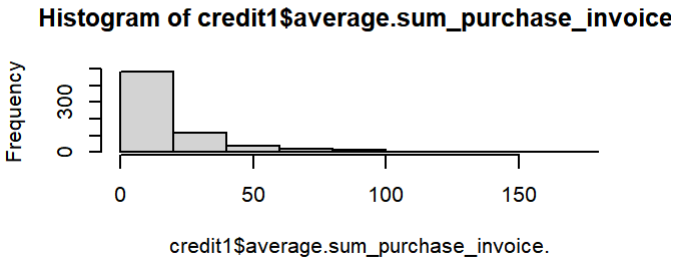




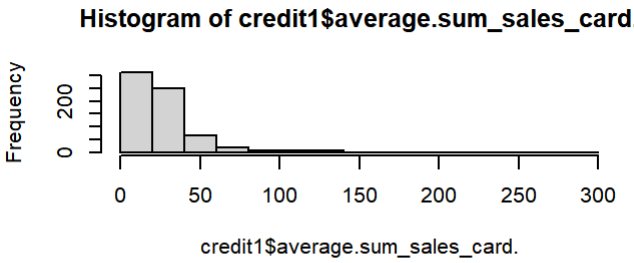


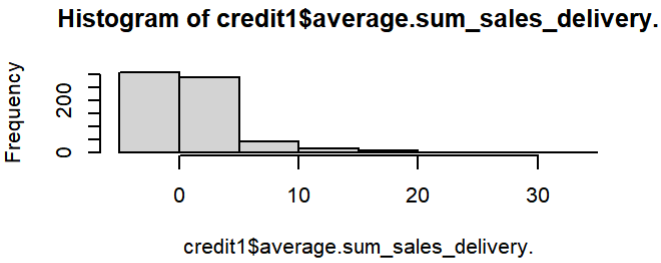


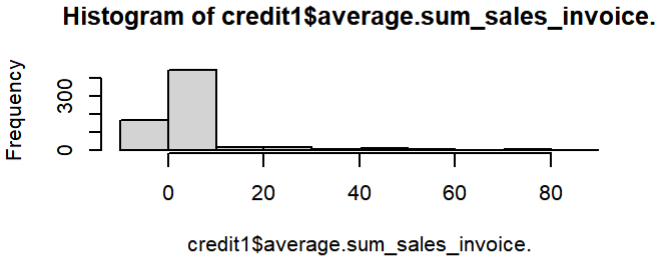


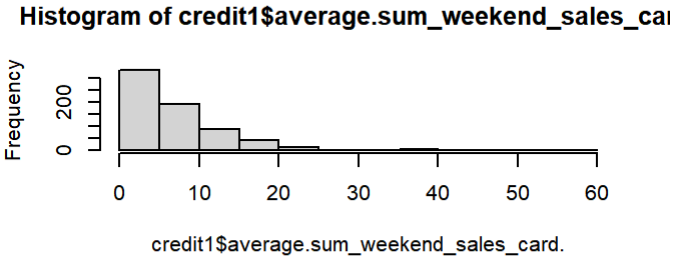


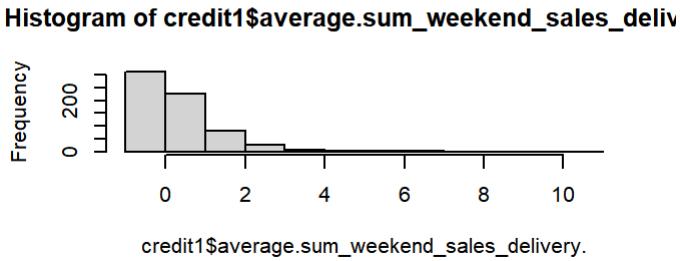

```
par(mfrow = c(3, 2))
hist(x=credit1$average.sum_sales_card.)
hist(x=credit1$average.sum_sales_delivery.)
hist(x=credit1$average.sum_sales_invoice.)
hist(x=credit1$average.sum_weekend_sales_card.)
hist(x=credit1$average.sum_weekend_sales_delivery.)
```











To use beta regression, target variable must be in (0, 1). Thus I changed 0 and 1 to 0.000001, 0.999999, respectively.

```
credit1[credit1['average.is_risky.']==0, 'average.is_risky.'] = rep(0.000001, length(credit1[cr
edit1['average.is_risky.']==0, 'average.is_risky.']))
credit1[credit1['average.is_risky.']==1, 'average.is_risky.'] = rep(0.999999, length(credit1[cr
edit1['average.is_risky.']==1, 'average.is_risky.']))
```

Cluster 0

Data standardization for [cluster 0 & 서비스업]

```
c0_s_ = credit1[(credit1['cluster']==0) & (credit1['class_1_name']=='서비스업'),]
c0_s_sub = c0_s_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler <- caret::preProcess(c0_s_sub, method=c('center', 'scale'))
c0_s_s = predict(standard_scaler, c0_s_sub)
c0_s_s['average.is_risky.'] = c0_s_$average.is_risky.
```

Data standardization for [cluster 0 & 유통업]

```
c0_u_ = credit1[(credit1['cluster']==0) & (credit1['class_1_name']=='유통업'),]
c0_u_sub = c0_u_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_u0 <- caret::preProcess(c0_u_sub, method=c('center', 'scale'))
c0_u_s = predict(standard_scaler_u0, c0_u_sub)
c0_u_s['average.is_risky.'] = c0_u_$average.is_risky.
```

Data standardization for [cluster 0 & 외식업]

```
c0_e_ = credit1[(credit1['cluster']==0) & (credit1['class_1_name']=='외식업'),]
c0_e_sub = c0_e_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_e0 <- caret::preProcess(c0_e_sub, method=c('center', 'scale'))
c0_e_s = predict(standard_scaler_e0, c0_e_sub)
c0_e_s['average.is_risky.'] = c0_e_$average.is_risky.
```

[cluster 0 & 서비스업] model fitting

```
model0_s_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.is_franchise. + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c0_s_s)

summary(model0_s_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c0_s_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -3.1834 -0.9882  0.3163  0.8155  2.4041
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                     -1.065796   0.061651 -17.287  < 2e-16 ***
## average.age.                    -0.231408   0.158498  -1.460  0.14429
## average.duration.               -0.196632   0.165148  -1.191  0.23379
## average.is_franchise.           -0.202569   0.201448  -1.006  0.31462
## average.business_square_size.    0.002766   0.289645   0.010  0.99238
## average.monthly_rental_fee.      0.084362   0.397775   0.212  0.83204
## average.regular_employees_count. -0.451423   0.143764  -3.140  0.00169 **
## average.rental_deposit.          0.192179   0.289648   0.663  0.50702
## average.sum_customer_cnt.       -0.204535   0.450868  -0.454  0.65008
## average.sum_new_customer_cnt.    0.267872   0.358903   0.746  0.45545
## average.sum_purchase_card.      -0.134518   0.111265  -1.209  0.22667
## average.sum_purchase_cash.       0.093515   0.092098   1.015  0.30992
## average.sum_purchase_invoice.   -0.310302   0.253566  -1.224  0.22105
## average.sum_sales_card.          1.267718   0.498494   2.543  0.01099 *
## average.sum_sales_delivery.      0.269459   0.086356   3.120  0.00181 **
## average.sum_sales_invoice.       0.216491   0.108038   2.004  0.04509 *
## average.sum_weekend_sales_card. -0.671390   0.434290  -1.546  0.12212
## average.sum_weekend_sales_delivery.  0.146216   0.114336   1.279  0.20096
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)   34.928      7.732   4.517 6.27e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 49.25 on 19 Df
## Pseudo R-squared: 0.4854
## Number of iterations: 32 (BFGS) + 2 (Fisher scoring)
```

[cluster 0 & 유통업] model fitting

```
model0_u_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.is_franchise. + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c0_u_s)

summary(model0_u_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c0_u_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -4.2558 -0.8265 -0.3613  0.6300  3.4148
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -0.92513    0.05141 -17.997  < 2e-16 ***
## average.age.                     -0.34897    0.22872  -1.526  0.12708
## average.duration.                 0.07843    0.26964   0.291  0.77114
## average.is_franchise.            -0.75103    0.25624  -2.931  0.00338 **
## average.business_square_size.    -0.38771    0.18589  -2.086  0.03700 *
## average.monthly_rental_fee.      -0.20324    0.20359  -0.998  0.31812
## average.regular_employees_count. -0.23502    0.11857  -1.982  0.04746 *
## average.rental_deposit.           0.42340    0.33688   1.257  0.20882
## average.sum_customer_cnt.         4.62458    2.51589   1.838  0.06604 .
## average.sum_new_customer_cnt.    -4.37599    2.09069  -2.093  0.03634 *
## average.sum_purchase_card.        0.31098    0.12279   2.533  0.01132 *
## average.sum_purchase_cash.        0.01121    0.15438   0.073  0.94210
## average.sum_purchase_invoice.     0.37495    0.26828   1.398  0.16223
## average.sum_sales_card.          -1.49490    0.76573  -1.952  0.05091 .
## average.sum_sales_delivery.      -1.24416    0.69772  -1.783  0.07456 .
## average.sum_sales_invoice.        0.11712    0.21114   0.555  0.57909
## average.sum_weekend_sales_card.   1.40629    0.64826   2.169  0.03006 *
## average.sum_weekend_sales_delivery.  1.06282    0.75711   1.404  0.16038
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)    68.92      18.32   3.763 0.000168 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 42.72 on 19 Df
## Pseudo R-squared: 0.7125
## Number of iterations: 39 (BFGS) + 4 (Fisher scoring)
```

[cluster 0 & 외식업] model fitting

```
model0_e_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.is_franchise. + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c0_e_s)

summary(model0_e_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c0_e_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -8.7600 -0.4056  0.1760  0.8418  2.3072
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -2.10777    0.06805 -30.973  < 2e-16 ***
## average.age.                     -0.10794    0.11209  -0.963 0.335573
## average.duration.                 0.06440    0.11506   0.560 0.575685
## average.is_franchise.             0.07119    0.09518   0.748 0.454510
## average.business_square_size.    -0.18599    0.09577  -1.942 0.052114 .
## average.monthly_rental_fee.      -0.32355    0.18021  -1.795 0.072585 .
## average.regular_employees_count. -0.17815    0.12867  -1.384 0.166215
## average.rental_deposit.           0.29191    0.14483   2.016 0.043851 *
## average.sum_customer_cnt.         0.40364    0.33995   1.187 0.235080
## average.sum_new_customer_cnt.    -0.56399    0.37016  -1.524 0.127596
## average.sum_purchase_card.        0.39495    0.11551   3.419 0.000628 ***
## average.sum_purchase_cash.       -0.04246    0.06926  -0.613 0.539822
## average.sum_purchase_invoice.     0.38182    0.24097   1.584 0.113083
## average.sum_sales_card.          -1.18982    0.30010  -3.965 7.35e-05 ***
## average.sum_sales_delivery.       0.41830    0.72187   0.579 0.562273
## average.sum_sales_invoice.        0.08546    0.05930   1.441 0.149530
## average.sum_weekend_sales_card.   0.49087    0.19062   2.575 0.010021 *
## average.sum_weekend_sales_delivery. -1.14157    0.71917  -1.587 0.112434
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)    20.34       2.77   7.344 2.08e-13 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 204.7 on 19 Df
## Pseudo R-squared: 0.4307
## Number of iterations: 65 (BFGS) + 2 (Fisher scoring)
```

Cluster 1

Data standardization for [cluster 1 & 서비스업]

```
c1_s_ = credit1[(credit1['cluster']==1) & (credit1['class_1_name']=='서비스업'),]
c1_s_sub = c1_s_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_s1 <- caret::preProcess(c1_s_sub, method=c('center', 'scale'))
c1_s_s = predict(standard_scaler_s1, c1_s_sub)
c1_s_s['average.is_risky.'] = c1_s_$average.is_risky.
```

Data standardization for [cluster 1 & 유통업]

```
c1_u_ = credit1[(credit1['cluster']==1) & (credit1['class_1_name']=='유통업'),]
c1_u_sub = c1_u_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_u1 <- caret::preProcess(c1_u_sub, method=c('center', 'scale'))
```

```
## Warning in preProcess.default(c1_u_sub, method = c("center", "scale")): These
## variables have zero variances: average.is_franchise.
```

```
c1_u_s = predict(standard_scaler_u1, c1_u_sub)
c1_u_s['average.is_risky.'] = c1_u_$average.is_risky.
```

Data standardization for [cluster 1 & 외식업]

```
c1_e_ = credit1[(credit1['cluster']==1) & (credit1['class_1_name']=='외식업'),]
c1_e_sub = c1_e_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_e1 <- caret::preProcess(c1_e_sub, method=c('center', 'scale'))
c1_e_s = predict(standard_scaler_e1, c1_e_sub)
c1_e_s['average.is_risky.'] = c1_e_$average.is_risky.
```

[cluster 1 & 서비스업] model fitting

```
model1_s_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                     + average.is_franchise. + average.business_square_size.
                     + average.monthly_rental_fee.
                     + average.regular_employees_count. + average.rental_deposit.
                     + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                     + average.sum_purchase_card. + average.sum_purchase_cash.
                     + average.sum_purchase_invoice. + average.sum_sales_card.
                     + average.sum_sales_delivery. + average.sum_sales_invoice.
                     + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                     , data= c1_s_s)

summary(model1_s_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c1_s_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -3.5736 -1.3136  0.0342  1.2892  3.1816
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -1.21672    0.06096 -19.959  < 2e-16 ***
## average.age.                      0.47616    0.45719   1.041  0.29765
## average.duration.                -0.92919    0.99364  -0.935  0.34972
## average.is_franchise.            -0.55916    0.26507  -2.109  0.03490 *
## average.business_square_size.    -7.64900    4.15460  -1.841  0.06561 .
## average.monthly_rental_fee.      -6.06679    3.25794  -1.862  0.06258 .
## average.regular_employees_count.  6.13591    3.23235   1.898  0.05766 .
## average.rental_deposit.           3.80829    8.34778   0.456  0.64824
## average.sum_customer_cnt.        -0.53841    4.31460  -0.125  0.90069
## average.sum_new_customer_cnt.     0.16191    3.49389   0.046  0.96304
## average.sum_purchase_card.        1.62803    0.87842   1.853  0.06383 .
## average.sum_purchase_cash.        0.86822    0.39226   2.213  0.02687 *
## average.sum_purchase_invoice.    -1.92749    1.30807  -1.474  0.14061
## average.sum_sales_card.          -1.69769    4.79627  -0.354  0.72337
## average.sum_sales_delivery.      -0.09258    0.15713  -0.589  0.55574
## average.sum_sales_invoice.        0.19512    0.19351   1.008  0.31329
## average.sum_weekend_sales_card.   5.35174    2.12314   2.521  0.01171 *
## average.sum_weekend_sales_delivery.  0.82180    0.29118   2.822  0.00477 **
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)    67.61      19.43    3.48 0.000502 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 38.13 on 19 Df
## Pseudo R-squared: 0.6807
## Number of iterations: 79 (BFGS) + 8 (Fisher scoring)
```

[cluster 1 & 유통업] model fitting

This model failed to converge with full model, so I removed ‘average.is_franchise’ from feature variables.

```
model1_u_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c1_u_s)

summary(model1_u_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.business_square_size. + average.monthly_rental_fee. + average.regular_employees_
count. +
##     average.rental_deposit. + average.sum_customer_cnt. + average.sum_new_customer_cnt. +
##     average.sum_purchase_card. + average.sum_purchase_cash. + average.sum_purchase_invoice.
+
##     average.sum_sales_card. + average.sum_sales_delivery. + average.sum_sales_invoice. +
##     average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.,
##     data = c1_u_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -2.3114 -1.2288 -0.1427  1.4474  2.6736
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                     -0.794101   0.053900 -14.733  < 2e-16 ***
## average.age.                    -0.405131   0.238274  -1.700  0.08908 .
## average.duration.               -0.269115   0.158501  -1.698  0.08953 .
## average.business_square_size.   -0.185109   0.703746  -0.263  0.79252
## average.monthly_rental_fee.     -0.247840   0.345417  -0.718  0.47306
## average.regular_employees_count.  1.114751   0.382465   2.915  0.00356 **
## average.rental_deposit.         -0.116174   0.705333  -0.165  0.86917
## average.sum_customer_cnt.       -0.134474   0.482037  -0.279  0.78027
## average.sum_new_customer_cnt.    0.573845   0.450409   1.274  0.20264
## average.sum_purchase_card.      -0.024456   0.113127  -0.216  0.82885
## average.sum_purchase_cash.      -0.024304   0.136109  -0.179  0.85828
## average.sum_purchase_invoice.    0.108985   0.186890   0.583  0.55979
## average.sum_sales_card.          0.097158   0.331202   0.293  0.76925
## average.sum_sales_delivery.     -0.004678   0.077065  -0.061  0.95160
## average.sum_sales_invoice.      -0.287786   0.205940  -1.397  0.16228
## average.sum_weekend_sales_card. -0.632337   0.312845  -2.021  0.04325 *
## average.sum_weekend_sales_delivery.  0.105630   0.099368   1.063  0.28777
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)    50.37      12.49   4.034 5.49e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 42.76 on 18 Df
## Pseudo R-squared: 0.4959
## Number of iterations: 33 (BFGS) + 2 (Fisher scoring)
```

[cluster 1 & 외식업] model fitting

```
model1_e_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.is_franchise. + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c1_e_s)

summary(model1_e_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c1_e_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -6.6111 -0.3234  0.3185  0.8146  1.5227
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -2.01952    0.09903 -20.393   <2e-16 ***
## average.age.                     -0.10996    0.14901  -0.738   0.4606
## average.duration.                 0.29296    0.14193   2.064   0.0390 *
## average.is_franchise.            -0.09392    0.12338  -0.761   0.4465
## average.business_square_size.    -0.12369    0.17923  -0.690   0.4901
## average.monthly_rental_fee.       0.41314    0.22886   1.805   0.0710 .
## average.regular_employees_count.  0.36589    0.17255   2.120   0.0340 *
## average.rental_deposit.          -0.20567    0.20321  -1.012   0.3115
## average.sum_customer_cnt.         0.30617    0.19285   1.588   0.1124
## average.sum_new_customer_cnt.    -0.45673    0.19700  -2.318   0.0204 *
## average.sum_purchase_card.        0.07821    0.10715   0.730   0.4655
## average.sum_purchase_cash.        0.13040    0.09488   1.374   0.1694
## average.sum_purchase_invoice.     0.13065    0.24894   0.525   0.5997
## average.sum_sales_card.          -0.40703    0.22766  -1.788   0.0738 .
## average.sum_sales_delivery.      -0.24227    0.82088  -0.295   0.7679
## average.sum_sales_invoice.       -0.08156    0.11877  -0.687   0.4923
## average.sum_weekend_sales_card.   0.22718    0.19417   1.170   0.2420
## average.sum_weekend_sales_delivery. -0.40522    0.83123  -0.487   0.6259
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)    9.762      1.487   6.564 5.25e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 138.8 on 19 Df
## Pseudo R-squared: 0.2328
## Number of iterations: 30 (BFGS) + 10 (Fisher scoring)
```

Cluster 2

Data standardization for [cluster 2 & 서비스업]

```
c2_s_ = credit1[(credit1['cluster']==2) & (credit1['class_1_name']=='서비스업'),]
c2_s_sub = c2_s_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_s2 <- caret::preProcess(c2_s_sub, method=c('center', 'scale'))
c2_s_s = predict(standard_scaler_s2, c2_s_sub)
c2_s_s['average.is_risky.'] = c2_s_$average.is_risky.
```

Data standardization for [cluster 2 & 유통업]

```
c2_u_ = credit1[(credit1['cluster']==2) & (credit1['class_1_name']=='유통업'),]
c2_u_sub = c2_u_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_u2 <- caret::preProcess(c2_u_sub, method=c('center', 'scale'))
c2_u_s = predict(standard_scaler_u2, c2_u_sub)
c2_u_s['average.is_risky.'] = c2_u_$average.is_risky.
```

Data standardization for [cluster 2 & 외식업]

```
c2_e_ = credit1[(credit1['cluster']==2) & (credit1['class_1_name']=='외식업'),]
c2_e_sub = c2_e_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_e2 <- caret::preProcess(c2_e_sub, method=c('center', 'scale'))
c2_e_s = predict(standard_scaler_e2, c2_e_sub)
c2_e_s['average.is_risky.'] = c2_e_$average.is_risky.
```

[cluster 2 & 서비스업] model fitting

```
model2_s_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                     + average.is_franchise. + average.business_square_size.
                     + average.monthly_rental_fee.
                     + average.regular_employees_count. + average.rental_deposit.
                     + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                     + average.sum_purchase_card. + average.sum_purchase_cash.
                     + average.sum_purchase_invoice. + average.sum_sales_card.
                     + average.sum_sales_delivery. + average.sum_sales_invoice.
                     + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                     , data= c2_s_s)

summary(model2_s_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c2_s_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -2.6767 -0.6238 -0.0704  0.7666  2.6379
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                     -1.187341   0.040407 -29.385  < 2e-16 ***
## average.age.                    -0.019355   0.091368  -0.212  0.83224
## average.duration.               -0.003536   0.080749  -0.044  0.96507
## average.is_franchise.            0.023537   0.057212   0.411  0.68077
## average.business_square_size.    0.452378   0.291758   1.551  0.12102
## average.monthly_rental_fee.     -0.465291   0.477477  -0.974  0.32982
## average.regular_employees_count. -0.162397   0.332969  -0.488  0.62574
## average.rental_deposit.          0.005730   0.224969   0.025  0.97968
## average.sum_customer_cnt.        0.343391   0.335451   1.024  0.30599
## average.sum_new_customer_cnt.   -0.398796   0.358144  -1.114  0.26549
## average.sum_purchase_card.       0.118277   0.167413   0.706  0.47988
## average.sum_purchase_cash.      -0.058397   0.068288  -0.855  0.39247
## average.sum_purchase_invoice.    0.696961   0.254036   2.744  0.00608 **
## average.sum_sales_card.          0.433613   0.394344   1.100  0.27152
## average.sum_sales_delivery.      0.077667   0.056728   1.369  0.17096
## average.sum_sales_invoice.       0.024429   0.107584   0.227  0.82037
## average.sum_weekend_sales_card. -0.948126   0.351419  -2.698  0.00698 **
## average.sum_weekend_sales_delivery. -0.035258   0.065354  -0.539  0.58955
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)   53.470      9.392   5.693 1.25e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 93.37 on 19 Df
## Pseudo R-squared: 0.4164
## Number of iterations: 31 (BFGS) + 2 (Fisher scoring)
```

[cluster 2 & 유통업] model fitting

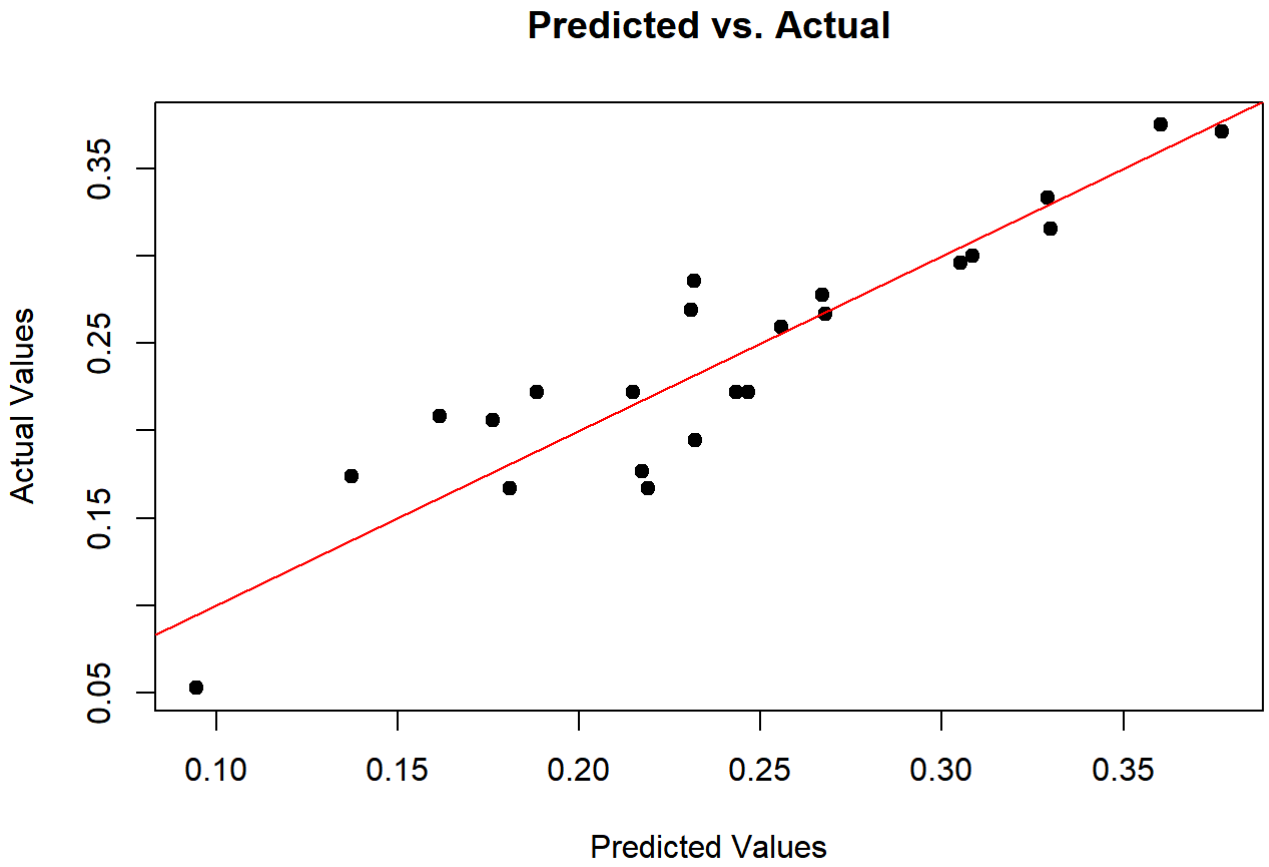
```
model2_u_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                     + average.is_franchise. + average.business_square_size.
                     + average.monthly_rental_fee.
                     + average.regular_employees_count. + average.rental_deposit.
                     + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                     + average.sum_purchase_card. + average.sum_purchase_cash.
                     + average.sum_purchase_invoice. + average.sum_sales_card.
                     + average.sum_sales_delivery. + average.sum_sales_invoice.
                     + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                     , data= c2_u_s)

summary(model2_u_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c2_u_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -4.3164 -1.4913  0.0035  1.5846  4.2636
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -1.17393    0.03705 -31.687  < 2e-16 ***
## average.age.                     -0.56006    0.63968  -0.876  0.38129
## average.duration.                 0.35897    0.41064   0.874  0.38203
## average.is_franchise.            -3.21190    0.71727  -4.478 7.54e-06 ***
## average.business_square_size.     0.78505    0.49443   1.588  0.11234
## average.monthly_rental_fee.       3.73095    0.87796   4.250 2.14e-05 ***
## average.regular_employees_count.  1.23110    0.64973   1.895  0.05812 .
## average.rental_deposit.          -0.10575    0.83176  -0.127  0.89883
## average.sum_customer_cnt.         0.70285    0.56326   1.248  0.21209
## average.sum_new_customer_cnt.    -1.10926    0.42952  -2.583  0.00981 **
## average.sum_purchase_card.       -4.67166    0.86348  -5.410 6.29e-08 ***
## average.sum_purchase_cash.       -0.32529    0.11184  -2.909  0.00363 **
## average.sum_purchase_invoice.    -0.07584    0.20594  -0.368  0.71269
## average.sum_sales_card.          -2.73553    0.38083  -7.183 6.81e-13 ***
## average.sum_sales_delivery.       0.60202    0.15379   3.914 9.06e-05 ***
## average.sum_sales_invoice.        1.50366    0.51392   2.926  0.00344 **
## average.sum_weekend_sales_card.   3.25729    0.44246   7.362 1.81e-13 ***
## average.sum_weekend_sales_delivery. -0.57598    0.21466  -2.683  0.00729 **
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)   176.38      50.82   3.471 0.000519 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 49.14 on 19 Df
## Pseudo R-squared: 0.8073
## Number of iterations: 70 (BFGS) + 2 (Fisher scoring)
```

Model fitting 결과, prediction과 actual y값(경영 위기 비율) 비교

```
plot(model2_u_$fitted.values, c2_u_s$average.is_risky., main="Predicted vs. Actual",
     xlab="Predicted Values", ylab="Actual Values", pch=19)
abline(a=0, b=1, col="red")
```



[cluster 2 & 외식업] model fitting

```
model2_e_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.is_franchise. + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c2_e_s)

summary(model2_e_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c2_e_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -8.2138 -0.5323 -0.0117  0.7620  2.4123
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -1.82317    0.05182 -35.185   <2e-16 ***
## average.age.                     -0.10687    0.10470  -1.021   0.3074
## average.duration.                 0.08895    0.08578   1.037   0.2997
## average.is_franchise.            -0.19418    0.10938  -1.775   0.0759 .
## average.business_square_size.    -0.15004    0.21435  -0.700   0.4839
## average.monthly_rental_fee.       0.28278    0.31889   0.887   0.3752
## average.regular_employees_count.  0.02356    0.14926   0.158   0.8746
## average.rental_deposit.          -0.06506    0.24910  -0.261   0.7939
## average.sum_customer_cnt.        -0.34038    0.15700  -2.168   0.0302 *
## average.sum_new_customer_cnt.     0.53426    0.27102   1.971   0.0487 *
## average.sum_purchase_card.        0.16109    0.11748   1.371   0.1703
## average.sum_purchase_cash.        0.14144    0.05998   2.358   0.0184 *
## average.sum_purchase_invoice.     0.44381    0.47888   0.927   0.3540
## average.sum_sales_card.          -0.57442    0.39749  -1.445   0.1484
## average.sum_sales_delivery.      -0.64733    0.68736  -0.942   0.3463
## average.sum_sales_invoice.        0.09607    0.07142   1.345   0.1786
## average.sum_weekend_sales_card.  -0.77997    0.30704  -2.540   0.0111 *
## average.sum_weekend_sales_delivery.  0.36300    0.69088   0.525   0.5993
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)   54.503      9.656   5.645 1.66e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 112.8 on 19 Df
## Pseudo R-squared: 0.3683
## Number of iterations: 66 (BFGS) + 10 (Fisher scoring)
```

Cluster 3

Data standardization for [cluster 3 & 서비스업]

```
c3_s_ = credit1[(credit1['cluster']==3) & (credit1['class_1_name']=='서비스업'),]
c3_s_sub = c3_s_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_s3 <- caret::preProcess(c3_s_sub, method=c('center', 'scale'))
c3_s_s = predict(standard_scaler_s3, c3_s_sub)
c3_s_s['average.is_risky.'] = c3_s_$average.is_risky.
```

Data standardization for [cluster 3 & 유통업]

```
c3_u_ = credit1[(credit1['cluster']==3) & (credit1['class_1_name']=='유통업'),]
c3_u_sub = c3_u_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_u3 <- caret::preProcess(c3_u_sub, method=c('center', 'scale'))
c3_u_s = predict(standard_scaler_u3, c3_u_sub)
c3_u_s['average.is_risky.'] = c3_u_$average.is_risky.
```

Data standardization for [cluster 3 & 외식업]

```
c3_e_ = credit1[(credit1['cluster']==3) & (credit1['class_1_name']=='외식업'),]
c3_e_sub = c3_e_[,c(5,6,7,8,10,11,12,13,14,15,16,17,18,19,20,21,22)]

standard_scaler_e3 <- caret::preProcess(c3_e_sub, method=c('center', 'scale'))
c3_e_s = predict(standard_scaler_e3, c3_e_sub)
c3_e_s['average.is_risky.'] = c3_e_$average.is_risky.
```

[cluster 3 & 서비스업] model fitting

```
model3_s_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                     + average.is_franchise. + average.business_square_size.
                     + average.monthly_rental_fee.
                     + average.regular_employees_count. + average.rental_deposit.
                     + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                     + average.sum_purchase_card. + average.sum_purchase_cash.
                     + average.sum_purchase_invoice. + average.sum_sales_card.
                     + average.sum_sales_delivery. + average.sum_sales_invoice.
                     + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                     , data= c3_s_s)

summary(model3_s_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c3_s_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -4.8700 -0.5398  0.0630  0.7385  3.1822
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                     -1.398299   0.050170 -27.871  < 2e-16 ***
## average.age.                    -0.220212   0.212038  -1.039 0.299014
## average.duration.                0.141130   0.164659   0.857 0.391387
## average.is_franchise.           -0.357432   0.096934  -3.687 0.000227 ***
## average.business_square_size.   -0.105667   0.173745  -0.608 0.543074
## average.monthly_rental_fee.      0.284866   0.281363   1.012 0.311322
## average.regular_employees_count. 0.002027   0.270062   0.008 0.994012
## average.rental_deposit.         -0.482858   0.348231  -1.387 0.165563
## average.sum_customer_cnt.       -0.187493   0.573154  -0.327 0.743573
## average.sum_new_customer_cnt.    0.339741   0.509755   0.666 0.505105
## average.sum_purchase_card.       0.073126   0.285207   0.256 0.797645
## average.sum_purchase_cash.      -0.165425   0.222020  -0.745 0.456217
## average.sum_purchase_invoice.    0.124029   0.362378   0.342 0.732151
## average.sum_sales_card.          0.521614   0.322568   1.617 0.105863
## average.sum_sales_delivery.      0.063960   0.083190   0.769 0.441989
## average.sum_sales_invoice.       0.204118   0.155297   1.314 0.188722
## average.sum_weekend_sales_card. -0.544363   0.258054  -2.109 0.034902 *
## average.sum_weekend_sales_delivery. -0.124330   0.086700  -1.434 0.151564
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)   49.991      9.757   5.124    3e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 78.08 on 19 Df
## Pseudo R-squared: 0.5945
## Number of iterations: 31 (BFGS) + 3 (Fisher scoring)
```

[cluster 3 & 유통업] model fitting

```
model3_u_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.is_franchise. + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c3_u_s)

summary(model3_u_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c3_u_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -2.7840 -0.9687  0.1205  1.0813  2.4165
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -0.82233    0.03986 -20.628  < 2e-16 ***
## average.age.                     -0.90839    0.34911  -2.602 0.009268 **
## average.duration.                 0.80159    0.27906   2.872 0.004072 **
## average.is_franchise.            -0.94376    0.22762  -4.146 3.38e-05 ***
## average.business_square_size.     0.16206    0.20471   0.792 0.428559
## average.monthly_rental_fee.       3.10018    0.56527   5.484 4.15e-08 ***
## average.regular_employees_count.  0.08265    0.49069   0.168 0.866233
## average.rental_deposit.          -2.91445    0.71890  -4.054 5.03e-05 ***
## average.sum_customer_cnt.         1.19824    0.86031   1.393 0.163681
## average.sum_new_customer_cnt.    -1.11867    0.79777  -1.402 0.160842
## average.sum_purchase_card.        0.32327    0.09299   3.476 0.000509 ***
## average.sum_purchase_cash.       -0.26067    0.09197  -2.834 0.004592 **
## average.sum_purchase_invoice.    -0.61817    0.33955  -1.821 0.068672 .
## average.sum_sales_card.          -1.02351    0.47581  -2.151 0.031468 *
## average.sum_sales_delivery.      -0.55121    0.14988  -3.678 0.000235 ***
## average.sum_sales_invoice.       -0.10507    0.18322  -0.573 0.566324
## average.sum_weekend_sales_card.   0.16051    0.52721   0.304 0.760783
## average.sum_weekend_sales_delivery.  0.69287    0.17346   3.994 6.49e-05 ***
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)    98.66      24.56   4.016 5.91e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 53.92 on 19 Df
## Pseudo R-squared: 0.8371
## Number of iterations: 35 (BFGS) + 2 (Fisher scoring)
```

[cluster 3 & 외식업] model fitting

```
model3_e_ <- betareg::betareg(average.is_risky. ~ average.age. + average.duration.
                    + average.is_franchise. + average.business_square_size.
                    + average.monthly_rental_fee.
                    + average.regular_employees_count. + average.rental_deposit.
                    + average.sum_customer_cnt. + average.sum_new_customer_cnt.
                    + average.sum_purchase_card. + average.sum_purchase_cash.
                    + average.sum_purchase_invoice. + average.sum_sales_card.
                    + average.sum_sales_delivery. + average.sum_sales_invoice.
                    + average.sum_weekend_sales_card. + average.sum_weekend_sales_delivery.
                    , data= c3_e_s)

summary(model3_e_)
```

```
##
## Call:
## betareg::betareg(formula = average.is_risky. ~ average.age. + average.duration. +
##     average.is_franchise. + average.business_square_size. + average.monthly_rental_fee. +
##     average.regular_employees_count. + average.rental_deposit. + average.sum_customer_cnt. +
##     average.sum_new_customer_cnt. + average.sum_purchase_card. + average.sum_purchase_cash.
+
##     average.sum_purchase_invoice. + average.sum_sales_card. + average.sum_sales_delivery. +
##     average.sum_sales_invoice. + average.sum_weekend_sales_card. + average.sum_weekend_sales
_delivery.,
##     data = c3_e_s)
##
## Standardized weighted residuals 2:
##     Min      1Q  Median      3Q     Max
## -9.9114 -0.3315  0.3821  0.8190  1.9483
##
## Coefficients (mean model with logit link):
##                                  Estimate Std. Error z value Pr(>|z|)
## (Intercept)                      -1.98950    0.09790 -20.322  < 2e-16 ***
## average.age.                     -0.03616    0.17239  -0.210  0.83388
## average.duration.                -0.05693    0.14350  -0.397  0.69158
## average.is_franchise.            -0.12053    0.14657  -0.822  0.41087
## average.business_square_size.    -0.21556    0.18227  -1.183  0.23696
## average.monthly_rental_fee.       0.13261    0.22375   0.593  0.55338
## average.regular_employees_count.  0.52368    0.17880   2.929  0.00340 **
## average.rental_deposit.           0.01669    0.08558   0.195  0.84536
## average.sum_customer_cnt.         0.86665    0.17427   4.973 6.59e-07 ***
## average.sum_new_customer_cnt.    -0.73671    0.19152  -3.847  0.00012 ***
## average.sum_purchase_card.        0.14280    0.13391   1.066  0.28624
## average.sum_purchase_cash.        0.19587    0.10054   1.948  0.05139 .
## average.sum_purchase_invoice.     0.24479    0.28169   0.869  0.38485
## average.sum_sales_card.          -0.69469    0.25905  -2.682  0.00733 **
## average.sum_sales_delivery.      -0.73817    0.42212  -1.749  0.08034 .
## average.sum_sales_invoice.       -0.28399    0.10887  -2.609  0.00909 **
## average.sum_weekend_sales_card.   0.46237    0.16588   2.787  0.00531 **
## average.sum_weekend_sales_delivery.  0.71412    0.37775   1.890  0.05870 .
##
## Phi coefficients (precision model with identity link):
##       Estimate Std. Error z value Pr(>|z|)
## (phi)    9.008      1.339   6.725 1.76e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Type of estimator: ML (maximum likelihood)
## Log-likelihood: 144.7 on 19 Df
## Pseudo R-squared: 0.275
## Number of iterations: 35 (BFGS) + 5 (Fisher scoring)
```