Group 300: Comprehensive Predictions on Google Play Store Apps

<u>Screenshots</u>

1) <u>Data Preprocessing</u>
   Quality Assessment

```
> #Gives the count of number of rows and columns present in the dataset.
> paste("No of Observation Is",nrow(app))
[1] "No of Observation Is 10841"
> paste("No of Variable Is",ncol(app))
[1] "No of Variable Is 13"
> #provides the statistics of the dataset
> summary(app)
```

```
                                                 App        Category        Rating         Reviews                Size
ROBLOX                                         :    9   FAMILY  :1972   Min.   :1.000   Min.   :      0   25M    :1839
CBS Sports App - Scores, News, Stats & watch Live:  8   GAME    :1144   1st Qu.:4.000   1st Qu.:     38   11M    : 198
8 Ball Pool                                    :    7   TOOLS   : 843   Median :4.300   Median :   2094   12M    : 198
Candy Crush Saga                               :    7   MEDICAL : 463   Mean   :4.191   Mean   :  444112   14M    : 194
Duolingo: Learn Languages Free                 :    7   BUSINESS: 460   3rd Qu.:4.500   3rd Qu.:  54768   13M    : 191
ESPN                                           :    7   PRODUCTIVITY: 424   Max.   :5.000   Max.   :78158308   15M    : 184
(Other)                                        :10796   (Other) :5535   NA's   :1474                      (Other):8039
      Installs        Type         Price           Content.Rating         Genres           Last.updated          Current.ver
 1,000,000+ :1579   Free:10040   0     :10041   Adults only 18+:    3   Tools     : 842   3-Aug-18 : 326   Varies with device:1459
 10,000,000+:1252   NaN :    1   $0.99 :  148   Everyone       :8715   Entertainment: 623   2-Aug-18 : 304   1                 : 842
 100,000+   :1169   Paid:  800   $2.99 :  129   Everyone 10+   : 414   Education  : 549   31-Jul-18: 294   1.1               : 276
 10,000+    :1054                $1.99 :   73   Mature 17+     : 499   Medical    : 463   1-Aug-18 : 285   1.2               : 185
 1,000+     : 908                $4.99 :   72   Teen           :1208   Business   : 460   30-Jul-18: 211   2                 : 165
 5,000,000+ : 752                $3.99 :   63   Unrated        :    2   Productivity: 424   25-Jul-18: 164   1.3               : 145
 (Other)    :4127                (Other): 315                          (Other)   :7480   (Other)  :9257   (Other)           :7769
      Android.ver
 4.1 and up         :2451
 4.0.3 and up       :1501
 4.0 and up         :1376
 Varies with device:1362
 4.4 and up         : 980
 2.3 and up         : 652
 (Other)            :2519
```

<u>Screenshot 1</u>

```
> # Data Preprocessing for Rating column.
> app$Rating<-ifelse(is.na(app$Rating),mean(app$Rating,na.rm=TRUE),app$Rating)
> app$Rating= round(app$Rating, digits=1)
> summary(app$Rating)
   Min. 1st Qu. Median   Mean 3rd Qu.   Max.
  1.000   4.100  4.200  4.193  4.500  5.000
> summary (app)
```

```
                                                 App        Category        Rating         Reviews                Size
ROBLOX                                         :    9   FAMILY  :1972   Min.   :1.000   Min.   :      0   25M    :1839
CBS Sports App - Scores, News, Stats & Watch Live:  8   GAME    :1144   1st Qu.:4.100   1st Qu.:     38   11M    : 198
8 Ball Pool                                    :    7   TOOLS   : 843   Median :4.200   Median :   2094   12M    : 196
Candy Crush Saga                               :    7   MEDICAL : 463   Mean   :4.193   Mean   :  444112   14M    : 194
Duolingo: Learn Languages Free                 :    7   BUSINESS: 460   3rd Qu.:4.500   3rd Qu.:  54768   13M    : 191
ESPN                                           :    7   PRODUCTIVITY: 424   Max.   :5.000   Max.   :78158306   15M    : 184
(Other)                                        :10796   (Other) :5535                                    (Other):8039
      Installs        Type         Price           Content.Rating         Genres           Last.Updated          Current.Ver
 1,000,000+ :1579   Free:10040   0     :10041   Adults only 18+:    3   Tools     : 842   3-Aug-18 : 326   Varies with device:1459
 10,000,000+:1252   NaN :    1   $0.99 :  148   Everyone       :8715   Entertainment: 623   2-Aug-18 : 304   1                 : 842
 100,000+   :1169   Paid:  800   $2.99 :  129   Everyone 10+   : 414   Education  : 549   31-Jul-18: 294   1.1               : 276
 10,000+    :1054                $1.99 :   73   Mature 17+     : 499   Medical    : 463   1-Aug-18 : 285   1.2               : 185
 1,000+     : 908                $4.99 :   72   Teen           :1208   Business   : 460   30-Jul-18: 211   2                 : 165
 5,000,000+ : 752                $3.99 :   63   Unrated        :    2   Productivity: 424   25-Jul-18: 164   1.3               : 145
 (Other)    :4127                (Other): 315                          (Other)   :7480   (Other)  :9257   (Other)           :7769
      Android.ver
 4.1 and up         :2451
 4.0.3 and up       :1501
 4.0 and up         :1376
 Varies with device:1362
 4.4 and up         : 980
 2.3 and up         : 652
 (Other)            :2519
```

<u>Screenshot 2</u>

```
> # Data Preprocessing for Type column.
> summary(app$Type)
 Free   NaN  Paid
10040    1   800
> app$Type<-  str_replace(app$Type, "NaN", "Free")
> app$Type <- as.factor(app$Type)
> summary(app)
```

App		Category		Rating		Reviews			Size	
ROBLOX	: 9	FAMILY	:1972	Min. :1.000	Min. :	0	25M	:1839		
CBS Sports App - Scores, News, Stats & watch Live:	8	GAME	:1144	1st Qu.:4.100	1st Qu.:	38	11M	: 198		
8 Ball Pool	: 7	TOOLS	: 843	Median :4.200	Median :	2094	12M	: 196		
Candy Crush Saga	: 7	MEDICAL	: 463	Mean :4.193	Mean :	444112	14M	: 194		
Duolingo: Learn Languages Free	: 7	BUSINESS	: 460	3rd Qu.:4.500	3rd Qu.:	54768	13M	: 191		
ESPN	: 7	PRODUCTIVITY:	424	Max. :5.000	Max. :78158306		15M	: 184		
(Other)	:10796	(Other)	:5535				(Other):8039			

Installs		Type		Price		Content.Rating		Genres		Last.Updated			Current.Ver	
1,000,000+ :1579		Free:10041		0	:10041	Adults only 18+:	3	Tools	: 842	3-Aug-18 : 326		Varies with device:1459		
10,000,000+:1252		Paid: 800		$0.99 :	148	Everyone	:8715	Entertainment:	623	2-Aug-18 : 304		1	: 842	
100,000+ :1169				$2.99 :	129	Everyone 10+	: 414	Education	: 549	31-Jul-18: 294		1.1	: 276	
10,000+ :1054				$1.99 :	73	Mature 17+	: 499	Medical	: 463	1-Aug-18 : 285		1.2	: 185	
1,000+ : 908				$4.99 :	72	Teen	:1208	Business	: 460	30-Jul-18: 211		2	: 165	
5,000,000+ : 752				$3.99 :	63	Unrated	: 2	Productivity :	424	25-Jul-18: 164		1.3	: 145	
(Other) :4127				(Other):	315			(Other)	:7480	(Other) :9257		(Other)	:7769	

	Android.Ver
4.1 and up	:2451
4.0.3 and up	:1501
4.0 and up	:1376
Varies with device:1362	
4.4 and up	: 980
2.3 and up	: 652
(Other)	:2519

Screenshot 3

Dimension Reduction

```
> # Data Cleaning for Size column.
> app$Size<-gsub("M","",app$Size)
> app$Size<-gsub("k","",app$Size)
> app$Size<-as.numeric(app$Size)
> head(app$Size)
[1] 19.0 14.0  8.7 25.0  2.8  5.6
> # Data Cleaning for Price column.
> app$Price<- str_replace(app$Price,"[$]","")
> app$Price = as.numeric(app$Price)
> summary(app$Price)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.000   0.000   0.000   1.027   0.000 400.000
> # Data Cleaning for Installs column.
> app$Installs<-gsub("[,]","",app$Installs)
> app$Installs<-gsub("[+]","",app$Installs)
> app$Installs <- as.factor(app$Installs)
> head(app$Installs)
[1] 10000    500000   5000000  50000000 100000    50000
Levels: 0 1 10 100 1000 10000 100000 1000000 10000000 :
```

Screenshot 4

```
> # Data Cleaning for Content.Rating column.
> summary(app$Content.Rating)
Adults only 18+      Everyone    Everyone 10+    Mature 17+        Teen      Unrated
             3          8715             414           499        1208            2
> indices= which(app$Content.Rating == "Unrated")
> indices
[1] 7313 8267
> app= app[c(-7313, -8267),]
> app$Content.Rating <- as.factor(app$Content.Rating)
> summary(app$Content.Rating)
Adults only 18+      Everyone    Everyone 10+    Mature 17+        Teen      Unrated
             3          8715             414           499        1208            0
> unique(app$Content.Rating)
[1] Everyone       Teen           Everyone 10+    Mature 17+    Adults only 18+
Levels: Adults only 18+ Everyone Everyone 10+ Mature 17+ Teen Unrated
```

Screenshot 5

```
> # Removing the columns.
> # They have been removed as they are not giving me enough information which is required
> #in my prediction analysis
> # Removing Columns like: Android.ver, Current.Ver, Last.Updated. Also
> # As category is similar to Genres. hence removed.
> app= app[,c(-10,-11,-12,-13)]
> #Changing the attribute
> app$Reviews<-as.numeric(app$Reviews)
> #Defines the various attributes of the coloumns.
> str(app)
'data.frame':    10839 obs. of  9 variables:
 $ App           : Factor w/ 9660 levels "\"i DT\" FÃ©tbol. Todos Somos TÃ©cnicos.",..: 7229 2563 8998
 $ Category      : Factor w/ 33 levels "ART_AND_DESIGN",..: 1 1 1 1 1 1 1 1 1 1 ...
 $ Rating        : num  4.1 3.9 4.7 4.5 4.3 4.4 3.8 4.1 4.4 4.7 ...
 $ Reviews       : num  159 967 87510 215644 967 ...
 $ Size          : num  19 14 8.7 25 2.8 5.6 19 29 33 3.1 ...
 $ Installs      : Factor w/ 20 levels "0","1","10","100",..: 6 17 18 19 7 16 16 8 8 6 ...
 $ Type          : Factor w/ 2 levels "Free","Paid": 1 1 1 1 1 1 1 1 1 1 ...
 $ Price         : num  0 0 0 0 0 0 0 0 0 0 ...
 $ Content.Rating: Factor w/ 6 levels "Adults only 18+",..: 2 2 2 5 2 2 2 2 2 2 ...
```

Screenshot 6

```
> #Changing the name
> dataset<-app
> #Viewing of the dataset after the cleaning and preprocessing.
> View(dataset)
> #Importing the preprocessed and cleaned CSV file.
> write.csv(dataset, "C:\\Users\\13128\\Desktop\\google-play-store-apps\\final output.csv")
```

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content.Rating
1	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0	Everyone
2	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0	Everyone
3	U Launcher Lite â€" FREE Live Cool Themes. Hide Apps	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0	Everyone
4	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0	Teen
5	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0	Everyone
6	Paper flowers instructions	ART_AND_DESIGN	4.4	167	5.6	50000	Free	0	Everyone
7	Smoke Effect Photo Maker - Smoke Editor	ART_AND_DESIGN	3.8	178	19.0	50000	Free	0	Everyone
8	Infinite Painter	ART_AND_DESIGN	4.1	36815	29.0	1000000	Free	0	Everyone
9	Garden Coloring Book	ART_AND_DESIGN	4.4	13791	33.0	1000000	Free	0	Everyone
10	Kids Paint Free - Drawing Fun	ART_AND_DESIGN	4.7	121	3.1	10000	Free	0	Everyone

Screenshot 7

Predicting the Analysis:

```
> #Building Anova model
> anova=lm(dataset$Rating~dataset$Category)
> summary(anova)

Call:
lm(formula = dataset$Rating ~ dataset$Category)

Residuals:
    Min      1Q  Median      3Q     Max
-3.2828 -0.1262  0.0558  0.2795  0.9910

Coefficients:
                                       Estimate Std. Error t value Pr(>|t|)
(Intercept)                             4.35077    0.05877  74.029  < 2e-16 ***
dataset$CategoryAUTO_AND_VEHICLES      -0.15900    0.07807  -2.037 0.041712 *
dataset$CategoryBEAUTY                 -0.08851    0.08769  -1.009 0.312872
dataset$CategoryBOOKS_AND_REFERENCE    -0.03822    0.06653  -0.574 0.565692
dataset$CategoryBUSINESS               -0.20251    0.06279  -3.225 0.001262 **
dataset$CategoryCOMICS                 -0.19410    0.08483  -2.288 0.022146 *
dataset$CategoryCOMMUNICATION          -0.18591    0.06351  -2.927 0.003429 **
dataset$CategoryDATING                 -0.34179    0.06643  -5.145 2.72e-07 ***
dataset$CategoryEDUCATION               0.03705    0.06995   0.530 0.596350
dataset$CategoryENTERTAINMENT          -0.22459    0.07043  -3.189 0.001433 **
dataset$CategoryEVENTS                  0.01486    0.08344   0.178 0.858691
dataset$CategoryFAMILY                 -0.15762    0.05973  -2.639 0.008333 **
dataset$CategoryFINANCE                -0.21088    0.06378  -3.307 0.000948 ***
dataset$CategoryFOOD_AND_DRINK         -0.17912    0.07226  -2.479 0.013202 *
dataset$CategoryGAME                   -0.06799    0.06042  -1.125 0.260474
dataset$CategoryHEALTH_AND_FITNESS     -0.08361    0.06413  -1.304 0.192310
dataset$CategoryHOUSE_AND_HOME         -0.15304    0.07749  -1.975 0.048305 *
dataset$CategoryLIBRARIES_AND_DEMO     -0.16724    0.07807  -2.142 0.032207 *
dataset$CategoryLIFESTYLE              -0.23716    0.06357  -3.730 0.000192 ***
dataset$CategoryMAPS_AND_NAVIGATION    -0.28508    0.07136  -3.995 6.52e-05 ***
dataset$CategoryMEDICAL                -0.15898    0.06276  -2.533 0.011321 *
dataset$CategoryNEWS_AND_MAGAZINES     -0.20660    0.06517  -3.170 0.001528 **
dataset$CategoryPARENTING              -0.06744    0.08483  -0.795 0.426649
dataset$CategoryPERSONALIZATION        -0.04797    0.06345  -0.756 0.449611
dataset$CategoryPHOTOGRAPHY            -0.15823    0.06422  -2.464 0.013759 *
dataset$CategoryPRODUCTIVITY           -0.14134    0.06312  -2.239 0.025155 *
dataset$CategorySHOPPING               -0.09615    0.06571  -1.463 0.143399
dataset$CategorySOCIAL                 -0.10196    0.06492  -1.570 0.116352
dataset$CategorySPORTS                 -0.13124    0.06355  -2.065 0.038938 *
dataset$CategoryTOOLS                  -0.28367    0.06100  -4.651 3.35e-06 ***
dataset$CategoryTRAVEL_AND_LOCAL       -0.23023    0.06576  -3.501 0.000465 ***
dataset$CategoryVIDEO_PLAYERS          -0.27534    0.06883  -4.001 6.36e-05 ***
dataset$CategoryWEATHER                -0.11053    0.07869  -1.405 0.160173
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4738 on 10806 degrees of freedom
Multiple R-squared:  0.02618,   Adjusted R-squared:  0.02329
F-statistic: 9.078 on 32 and 10806 DF,  p-value: < 2.2e-16
```
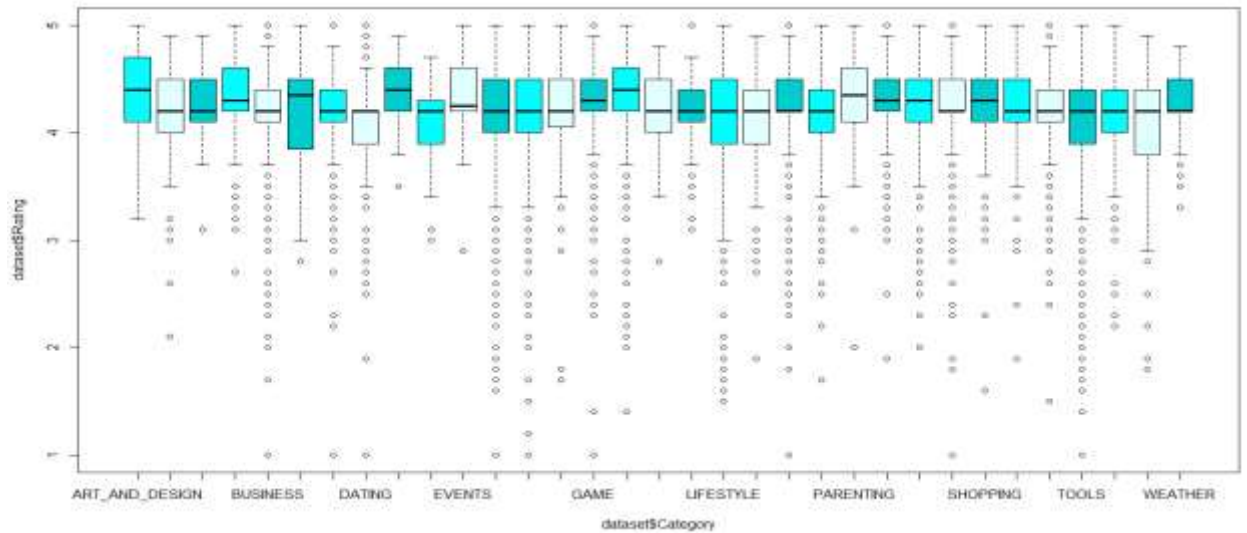
Screenshot 8

Screenshot 9

```
> #Building linear regression model.
> # our multiple linear model
> multiple<- lm(Rating~ Category+Type+Size+Price+Reviews+Installs+Content.Rating, data= dataset)
> summary(multiple)

Call:
lm(formula = Rating ~ Category + Type + Size + Price + Reviews +
    Installs + Content.Rating, data = dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-3.4003 -0.1489  0.0426  0.2575  1.0816

Coefficients:
                              Estimate Std. Error t value Pr(>|t|)
(Intercept)                   4.474e+00  3.012e-01  14.852  < 2e-16 ***
CategoryAUTO_AND_VEHICLES    -1.838e-01  7.624e-02  -2.411  0.015907 *
CategoryBEAUTY               -8.520e-02  8.560e-02  -0.995  0.319587
CategoryBOOKS_AND_REFERENCE  -8.458e-02  6.508e-02  -1.300  0.193737
CategoryBUSINESS             -2.591e-01  6.155e-02  -4.210  2.58e-05 ***
CategoryCOMICS               -1.915e-01  8.353e-02  -2.293  0.021876 *
CategoryCOMMUNICATION        -2.992e-01  6.235e-02  -4.798  1.63e-06 ***
CategoryDATING               -3.507e-01  6.898e-02  -5.084  3.75e-07 ***
CategoryEDUCATION            -4.993e-02  6.846e-02  -0.729  0.465808
CategoryENTERTAINMENT        -3.584e-01  6.973e-02  -5.140  2.80e-07 ***
CategoryEVENTS               -7.161e-03  8.159e-02  -0.088  0.930066
CategoryFAMILY               -2.029e-01  5.842e-02  -3.472  0.000518 ***
CategoryFINANCE              -2.281e-01  6.236e-02  -3.658  0.000256 ***
CategoryFOOD_AND_DRINK       -2.435e-01  7.062e-02  -3.447  0.000568 ***
CategoryGAME                 -1.879e-01  5.943e-02  -3.161  0.001578 **
CategoryHEALTH_AND_FITNESS   -1.570e-01  6.273e-02  -2.503  0.012334 *
CategoryHOUSE_AND_HOME       -2.077e-01  7.571e-02  -2.744  0.006078 **
CategoryLIBRARIES_AND_DEMO   -1.341e-01  7.662e-02  -1.750  0.080166 .
CategoryLIFESTYLE            -2.641e-01  6.218e-02  -4.251  2.15e-05 ***
CategoryMAPS_AND_NAVIGATION  -3.336e-01  6.974e-02  -4.784  1.74e-06 ***
CategoryMEDICAL              -1.899e-01  6.151e-02  -3.087  0.002026 **
CategoryNEWS_AND_MAGAZINES   -2.518e-01  6.400e-02  -3.935  8.38e-05 ***
CategoryPARENTING            -5.914e-02  8.278e-02  -0.714  0.475022
CategoryPERSONALIZATION      -1.277e-01  6.216e-02  -2.055  0.039901 *
CategoryPHOTOGRAPHY          -2.858e-01  6.296e-02  -4.539  5.72e-06 ***
CategoryPRODUCTIVITY         -2.378e-01  6.182e-02  -3.847  0.000120 ***
CategorySHOPPING             -2.046e-01  6.437e-02  -3.179  0.001480 **
CategorySOCIAL               -1.905e-01  6.420e-02  -2.967  0.003015 **
CategorySPORTS               -2.049e-01  6.218e-02  -3.295  0.000987 ***
CategoryTOOLS                -3.370e-01  5.965e-02  -5.650  1.65e-08 ***
CategoryTRAVEL_AND_LOCAL     -3.016e-01  6.432e-02  -4.688  2.79e-06 ***
CategoryVIDEO_PLAYERS        -3.524e-01  6.732e-02  -5.235  1.68e-07 ***
CategoryWEATHER              -1.916e-01  7.690e-02  -2.491  0.012737 *
TypePaid                      1.279e-01  1.842e-02   6.943  4.05e-12 ***
Size                         -1.137e-04  4.963e-05  -2.292  0.021952 *
Price                        -7.168e-04  2.922e-04  -2.453  0.014188 *
Reviews                       4.705e-09  2.047e-09   2.299  0.021533 *
```

Screenshot 10

```
Installs1                      4.114e-02   1.340e-01    0.307  0.758849
Installs10                     9.989e-02   1.239e-01    0.806  0.420157
Installs100                    1.073e-01   1.229e-01    0.873  0.382495
Installs1000                  -7.785e-02   1.225e-01   -0.635  0.525154
Installs10000                 -1.190e-01   1.224e-01   -0.972  0.331252
Installs100000                -5.482e-02   1.225e-01   -0.448  0.654456
Installs1000000                6.995e-02   1.224e-01    0.571  0.567714
Installs10000000               1.660e-01   1.226e-01    1.354  0.175762
Installs100000000              2.482e-01   1.245e-01    1.993  0.046235  *
Installs1000000000             4.670e-02   1.431e-01    0.326  0.744230
Installs5                      7.283e-02   1.320e-01    0.552  0.581159
Installs50                     9.086e-02   1.259e-01    0.722  0.470496
Installs500                    2.683e-02   1.244e-01    0.216  0.829224
Installs5000                  -1.182e-01   1.234e-01   -0.958  0.338209
Installs50000                 -1.130e-01   1.235e-01   -0.915  0.360076
Installs500000                 2.050e-03   1.235e-01    0.017  0.986749
Installs5000000                9.138e-02   1.230e-01    0.743  0.457628
Installs50000000               2.024e-01   1.250e-01    1.619  0.105393
Installs500000000              1.815e-01   1.352e-01    1.343  0.179392
Content.RatingEveryone        -9.450e-02   2.702e-01   -0.350  0.726583
Content.RatingEveryone 10+    -9.899e-02   2.711e-01   -0.365  0.715017
Content.RatingMature 17+      -1.264e-01   2.712e-01   -0.466  0.641206
Content.RatingTeen            -9.397e-02   2.704e-01   -0.347  0.728225
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.462 on 10779 degrees of freedom
Multiple R-squared:  0.0766,     Adjusted R-squared:  0.07155
F-statistic: 15.16 on 59 and 10779 DF,  p-value: < 2.2e-16
```

Screenshot 11

- *Now we will build another model which will have just the above variables.*

```
> multiple2<- lm(Rating~ Category+Type+Size+Price+Reviews, data= dataset)
> summary(multiple2)

Call:
lm(formula = Rating ~ Category + Type + Size + Price + Reviews,
    data = dataset)

Residuals:
    Min      1Q  Median      3Q     Max
-3.2679 -0.1423  0.0568  0.2569  1.0002

Coefficients:
                            Estimate Std. Error t value Pr(>|t|)
(Intercept)                4.349e+00  5.861e-02  74.197  < 2e-16 ***
CategoryAUTO_AND_VEHICLES -1.554e-01  7.785e-02  -1.996 0.045960 *
CategoryBEAUTY            -8.461e-02  8.744e-02  -0.968 0.333260
CategoryBOOKS_AND_REFERENCE -4.114e-02 6.636e-02  -0.620 0.535320
CategoryBUSINESS         -1.994e-01  6.261e-02  -3.185 0.001452 **
CategoryCOMICS           -1.884e-01  8.459e-02  -2.228 0.025923 *
CategoryCOMMUNICATION    -2.051e-01  6.344e-02  -3.232 0.001231 **
CategoryDATING           -3.400e-01  6.624e-02  -5.133 2.91e-07 ***
CategoryEDUCATION         3.830e-02  6.976e-02   0.549 0.582987
CategoryENTERTAINMENT    -2.247e-01  7.024e-02  -3.199 0.001382 **
CategoryEVENTS            1.963e-02  8.320e-02   0.236 0.813529
CategoryFAMILY           -1.594e-01  5.958e-02  -2.676 0.007459 **
CategoryFINANCE          -2.032e-01  6.364e-02  -3.193 0.001414 **
CategoryFOOD_AND_DRINK   -1.760e-01  7.206e-02  -2.443 0.014591 *
CategoryGAME             -8.016e-02  6.030e-02  -1.329 0.183795
CategoryHEALTH_AND_FITNESS -8.165e-02 6.395e-02  -1.277 0.201749
CategoryHOUSE_AND_HOME   -1.482e-01  7.728e-02  -1.918 0.055177 .
CategoryLIBRARIES_AND_DEMO -1.439e-01 7.829e-02  -1.838 0.066093 .
CategoryLIFESTYLE        -2.306e-01  6.342e-02  -3.636 0.000278 ***
CategoryMAPS_AND_NAVIGATION -2.841e-01 7.116e-02  -3.993 6.57e-05 ***
CategoryMEDICAL          -1.670e-01  6.268e-02  -2.664 0.007722 **
CategoryNEWS_AND_MAGAZINES -2.049e-01 6.499e-02  -3.153 0.001621 **
CategoryPARENTING        -6.505e-02  8.458e-02  -0.769 0.441878
CategoryPERSONALIZATION  -5.888e-02  6.335e-02  -0.930 0.352648
CategoryPHOTOGRAPHY      -1.647e-01  6.404e-02  -2.571 0.010146 *
CategoryPRODUCTIVITY     -1.425e-01  6.294e-02  -2.264 0.023595 *
CategorySHOPPING         -9.540e-02  6.553e-02  -1.456 0.145496
CategorySOCIAL           -1.192e-01  6.482e-02  -1.839 0.065877 .
CategorySPORTS           -1.317e-01  6.337e-02  -2.078 0.037719 *
CategoryTOOLS            -2.861e-01  6.085e-02  -4.701 2.62e-06 ***
CategoryTRAVEL_AND_LOCAL -2.308e-01  6.557e-02  -3.520 0.000434 ***
CategoryVIDEO_PLAYERS    -2.786e-01  6.864e-02  -4.060 4.95e-05 ***
CategoryWEATHER          -1.144e-01  7.847e-02  -1.458 0.144849
TypePaid                  7.634e-02  1.827e-02   4.179 2.95e-05 ***
Size                     -1.271e-04  5.069e-05  -2.507 0.012179 *
Price                    -7.664e-04  2.943e-04  -2.604 0.009221 **
Reviews                   1.041e-08  1.583e-09   6.577 5.03e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4725 on 10802 degrees of freedom
Multiple R-squared:  0.03216,   Adjusted R-squared:  0.02894
F-statistic: 9.972 on 36 and 10802 DF,  p-value: < 2.2e-16
```

Screenshot 12

- *Now we will perform forward selection model for the new model that we have used.*

```
> #Performing stepwise forward regression
> ols_step_forward_p(multiple2, details= TRUE)
Forward Selection Method
--------------------------

Candidate Terms:

1. Category
2. Type
3. Size
4. Price
5. Reviews

We are selecting variables based on p value...


Forward Selection: Step 1

+ Category

                        Model Summary
-------------------------------------------------------------
R                        0.162        RMSE                  0.474
R-Squared                0.026        Coef. Var            11.301
Adj. R-Squared           0.023        MSE                   0.225
Pred R-Squared           0.021        MAE                   0.316
-------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                             ANOVA
-----------------------------------------------------------------------
              Sum of
              Squares         DF    Mean Square      F        Sig.
-----------------------------------------------------------------------
Regression    65.218          32         2.038     9.078     0.0000
Residual      2426.061      10806        0.225
Total         2491.278      10838
-----------------------------------------------------------------------
```

Screenshot 13

```
                              Parameter Estimates
-------------------------------------------------------------------------------------
                    model     Beta   Std. Error   Std. Beta     t       Sig    lower    upper
-------------------------------------------------------------------------------------
                (Intercept)   4.351     0.059                 74.029   0.000   4.236    4.466
    CategoryAUTO_AND_VEHICLES -0.159    0.078      -0.029      -2.037   0.042  -0.312   -0.006
             CategoryBEAUTY   -0.089     0.088      -0.013      -1.009   0.313  -0.260    0.083
  CategoryBOOKS_AND_REFERENCE -0.038    0.067      -0.012      -0.574   0.566  -0.169    0.092
           CategoryBUSINESS   -0.203     0.063      -0.085      -3.225   0.001  -0.326   -0.079
             CategoryCOMICS   -0.194     0.085      -0.030      -2.288   0.022  -0.360   -0.028
      CategoryCOMMUNICATION   -0.186     0.064      -0.072      -2.927   0.003  -0.310   -0.061
            CategoryDATING    -0.342     0.066      -0.104      -5.145   0.000  -0.472   -0.212
          CategoryEDUCATION    0.037     0.070       0.009       0.530   0.596  -0.100    0.174
      CategoryENTERTAINMENT   -0.225     0.070      -0.055      -3.189   0.001  -0.363   -0.087
            CategoryEVENTS     0.015     0.083       0.002       0.178   0.859  -0.149    0.178
            CategoryFAMILY    -0.158     0.060      -0.127      -2.639   0.008  -0.275   -0.041
           CategoryFINANCE    -0.211     0.064      -0.079      -3.307   0.001  -0.336   -0.086
     CategoryFOOD_AND_DRINK   -0.179     0.072      -0.040      -2.479   0.013  -0.321   -0.037
              CategoryGAME    -0.068     0.060      -0.044      -1.125   0.260  -0.186    0.050
  CategoryHEALTH_AND_FITNESS  -0.084     0.064      -0.030      -1.304   0.192  -0.209    0.042
    CategoryHOUSE_AND_HOME    -0.153     0.077      -0.029      -1.975   0.048  -0.305   -0.001
  CategoryLIBRARIES_AND_DEMO  -0.167     0.078      -0.031      -2.142   0.032  -0.320   -0.014
          CategoryLIFESTYLE   -0.237     0.064      -0.091      -3.730   0.000  -0.362   -0.113
 CategoryMAPS_AND_NAVIGATION  -0.285     0.071      -0.066      -3.995   0.000  -0.425   -0.145
           CategoryMEDICAL    -0.159     0.063      -0.067      -2.533   0.011  -0.282   -0.036
  CategoryNEWS_AND_MAGAZINES  -0.207     0.065      -0.069      -3.170   0.002  -0.334   -0.079
         CategoryPARENTING    -0.067     0.085      -0.010      -0.795   0.427  -0.234    0.099
   CategoryPERSONALIZATION    -0.048     0.063      -0.019      -0.756   0.450  -0.172    0.076
        CategoryPHOTOGRAPHY   -0.158     0.064      -0.057      -2.464   0.014  -0.284   -0.032
       CategoryPRODUCTIVITY   -0.141     0.063      -0.057      -2.239   0.025  -0.265   -0.018
           CategorySHOPPING   -0.096     0.066      -0.031      -1.463   0.143  -0.225    0.033
             CategorySOCIAL   -0.102     0.065      -0.035      -1.570   0.116  -0.229    0.025
             CategorySPORTS   -0.131     0.064      -0.051      -2.065   0.039  -0.256   -0.007
              CategoryTOOLS   -0.284     0.061      -0.158      -4.651   0.000  -0.403   -0.164
    CategoryTRAVEL_AND_LOCAL  -0.230     0.066      -0.073      -3.501   0.000  -0.359   -0.101
      CategoryVIDEO_PLAYERS   -0.275     0.069      -0.072      -4.001   0.000  -0.410   -0.140
            CategoryWEATHER   -0.111     0.079      -0.020      -1.405   0.160  -0.265    0.044
-------------------------------------------------------------------------------------
```

Screenshot 14

Forward Selection: Step 2

+ Reviews

```
                    Model Summary
----------------------------------------------------------
R                    0.173        RMSE              0.473
R-Squared            0.030        Coef. Var        11.280
Adj. R-Squared       0.027        MSE               0.224
Pred R-Squared       0.024        MAE               0.314
----------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

```
                            ANOVA
------------------------------------------------------------------
              Sum of
              Squares        DF    Mean Square      F       Sig.
------------------------------------------------------------------
Regression     74.403        33       2.255       10.08    0.0000
Residual     2416.875     10805       0.224
Total        2491.278     10838
------------------------------------------------------------------
```

Screenshot 15

```
                              Parameter Estimates
-------------------------------------------------------------------------------------
             model      Beta   Std. Error   Std. Beta      t      Sig    lower    upper
-------------------------------------------------------------------------------------
           (Intercept)  4.351     0.059                 74.162   0.000   4.236    4.465
CategoryAUTO_AND_VEHICLES -0.159   0.078      -0.029     -2.039   0.041  -0.312   -0.006
         CategoryBEAUTY -0.088     0.088      -0.013     -1.009   0.313  -0.260    0.083
CategoryBOOKS_AND_REFERENCE -0.039  0.066     -0.012     -0.586   0.558  -0.169    0.091
       CategoryBUSINESS -0.203     0.063      -0.085     -3.232   0.001  -0.325   -0.080
         CategoryCOMICS -0.194     0.085      -0.030     -2.296   0.022  -0.360   -0.028
  CategoryCOMMUNICATION -0.207     0.063      -0.080     -3.261   0.001  -0.331   -0.083
         CategoryDATING -0.342     0.066      -0.104     -5.155   0.000  -0.472   -0.212
      CategoryEDUCATION  0.035     0.070       0.009      0.498   0.619  -0.102    0.172
  CategoryENTERTAINMENT -0.228     0.070      -0.055     -3.248   0.001  -0.366   -0.091
         CategoryEVENTS  0.015     0.083       0.002      0.181   0.856  -0.148    0.178
         CategoryFAMILY -0.159     0.060      -0.128     -2.675   0.007  -0.276   -0.043
        CategoryFINANCE -0.211     0.064      -0.080     -3.316   0.001  -0.336   -0.086
  CategoryFOOD_AND_DRINK -0.180    0.072      -0.040     -2.489   0.013  -0.321   -0.038
           CategoryGAME -0.082     0.060      -0.052     -1.355   0.175  -0.200    0.037
CategoryHEALTH_AND_FITNESS -0.084  0.064      -0.031     -1.320   0.187  -0.210    0.041
   CategoryHOUSE_AND_HOME -0.153   0.077      -0.029     -1.981   0.048  -0.305   -0.002
 CategoryLIBRARIES_AND_DEMO -0.167 0.078      -0.031     -2.144   0.032  -0.320   -0.014
      CategoryLIFESTYLE -0.237     0.063      -0.091     -3.738   0.000  -0.362   -0.113
CategoryMAPS_AND_NAVIGATION -0.287  0.071     -0.067     -4.030   0.000  -0.427   -0.147
        CategoryMEDICAL -0.159     0.063      -0.067     -2.534   0.011  -0.282   -0.036
CategoryNEWS_AND_MAGAZINES -0.208  0.065      -0.069     -3.202   0.001  -0.336   -0.081
      CategoryPARENTING -0.067     0.085      -0.010     -0.795   0.427  -0.233    0.099
 CategoryPERSONALIZATION -0.050    0.063      -0.019     -0.790   0.430  -0.174    0.074
    CategoryPHOTOGRAPHY -0.164     0.064      -0.059     -2.565   0.010  -0.290   -0.039
   CategoryPRODUCTIVITY -0.144     0.063      -0.058     -2.283   0.022  -0.267   -0.020
       CategorySHOPPING -0.100     0.066      -0.032     -1.530   0.126  -0.229    0.028
         CategorySOCIAL -0.123     0.065      -0.042     -1.896   0.058  -0.250    0.004
         CategorySPORTS -0.133     0.063      -0.051     -2.094   0.036  -0.257   -0.009
          CategoryTOOLS -0.287     0.061      -0.160     -4.709   0.000  -0.406   -0.167
CategoryTRAVEL_AND_LOCAL -0.232    0.066      -0.074     -3.541   0.000  -0.361   -0.104
  CategoryVIDEO_PLAYERS -0.281     0.069      -0.074     -4.097   0.000  -0.416   -0.147
        CategoryWEATHER -0.112     0.079      -0.020     -1.427   0.154  -0.266    0.042
                Reviews  0.000     0.000       0.062      6.408   0.000   0.000    0.000
-------------------------------------------------------------------------------------
```

Screenshot 16

```
Forward Selection: Step 3

+ Type

                      Model Summary
------------------------------------------------------------
R                     0.176      RMSE                0.473
R-Squared             0.031      Coef. Var           11.274
Adj. R-Squared        0.028      MSE                 0.223
Pred R-Squared        0.025      MAE                 0.315
------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                        ANOVA
------------------------------------------------------------
             Sum of
             Squares      DF    Mean Square    F       Sig.
------------------------------------------------------------
Regression   77.201       34       2.271    10.162    0.0000
Residual     2414.077     10804    0.223
Total        2491.278     10838
------------------------------------------------------------

                        Parameter Estimates
------------------------------------------------------------------------------------
            model       Beta    Std. Error   Std. Beta     t      Sig    lower   upper
------------------------------------------------------------------------------------
       (Intercept)      4.348     0.059                   74.145  0.000   4.233   4.463
CategoryAUTO_AND_VEHICLES  -0.158  0.078     -0.029       -2.031  0.042  -0.311  -0.006
        CategoryBEAUTY    -0.085   0.087     -0.012       -0.976  0.329  -0.257   0.086
CategoryBOOKS_AND_REFERENCE -0.044 0.066     -0.013       -0.657  0.511  -0.174   0.086
      CategoryBUSINESS    -0.202   0.063     -0.085       -3.218  0.001  -0.324  -0.079
        CategoryCOMICS    -0.192   0.085     -0.030       -2.263  0.024  -0.357  -0.026
 CategoryCOMMUNICATION    -0.209   0.063     -0.081       -3.293  0.001  -0.333  -0.085
       CategoryDATING     -0.341   0.066     -0.103       -5.142  0.000  -0.471  -0.211
     CategoryEDUCATION     0.036   0.070      0.009        0.516  0.606  -0.101   0.173
 CategoryENTERTAINMENT    -0.226   0.070     -0.055       -3.222  0.001  -0.364  -0.089
       CategoryEVENTS      0.017   0.083      0.003        0.204  0.838  -0.146   0.180
       CategoryFAMILY     -0.163   0.060     -0.131       -2.730  0.006  -0.280  -0.046
      CategoryFINANCE     -0.211   0.064     -0.080       -3.318  0.001  -0.336  -0.086
 CategoryFOOD_AND_DRINK   -0.178   0.072     -0.040       -2.464  0.014  -0.319  -0.036
         CategoryGAME     -0.084   0.060     -0.054       -1.388  0.165  -0.202   0.035
CategoryHEALTH_AND_FITNESS -0.085  0.064     -0.031       -1.321  0.186  -0.210   0.041
 CategoryHOUSE_AND_HOME   -0.150   0.077     -0.028       -1.945  0.052  -0.302   0.001
CategoryLIBRARIES_AND_DEMO -0.165  0.078     -0.030       -2.118  0.034  -0.318  -0.012
     CategoryLIFESTYLE    -0.237   0.063     -0.091       -3.744  0.000  -0.362  -0.113
CategoryMAPS_AND_NAVIGATION -0.287 0.071     -0.067       -4.024  0.000  -0.426  -0.147
       CategoryMEDICAL    -0.171   0.063     -0.072       -2.721  0.007  -0.294  -0.048
CategoryNEWS_AND_MAGAZINES -0.206  0.065     -0.068       -3.166  0.002  -0.333  -0.078
     CategoryPARENTING    -0.067   0.085     -0.010       -0.786  0.432  -0.232   0.099
CategoryPERSONALIZATION   -0.060   0.063     -0.024       -0.954  0.340  -0.185   0.064
   CategoryPHOTOGRAPHY    -0.166   0.064     -0.060       -2.587  0.010  -0.291  -0.040
   CategoryPRODUCTIVITY   -0.145   0.063     -0.059       -2.304  0.021  -0.269  -0.022
```

Screenshot 17

CategoryLIFESTYLE	-0.237	0.063	-0.091	-3.744	0.000	-0.362	-0.113
CategoryMAPS_AND_NAVIGATION	-0.287	0.071	-0.067	-4.024	0.000	-0.426	-0.147
CategoryMEDICAL	-0.171	0.063	-0.072	-2.721	0.007	-0.294	-0.048
CategoryNEWS_AND_MAGAZINES	-0.206	0.065	-0.068	-3.166	0.002	-0.333	-0.078
CategoryPARENTING	-0.067	0.085	-0.010	-0.786	0.432	-0.232	0.099
CategoryPERSONALIZATION	-0.060	0.063	-0.024	-0.954	0.340	-0.185	0.064
CategoryPHOTOGRAPHY	-0.166	0.064	-0.060	-2.587	0.010	-0.291	-0.040
CategoryPRODUCTIVITY	-0.145	0.063	-0.059	-2.304	0.021	-0.269	-0.022
CategorySHOPPING	-0.098	0.066	-0.031	-1.496	0.135	-0.227	0.030
CategorySOCIAL	-0.121	0.065	-0.041	-1.869	0.062	-0.248	0.006
CategorySPORTS	-0.134	0.063	-0.052	-2.112	0.035	-0.258	-0.010
CategoryTOOLS	-0.290	0.061	-0.162	-4.760	0.000	-0.409	-0.170
CategoryTRAVEL_AND_LOCAL	-0.232	0.066	-0.074	-3.544	0.000	-0.361	-0.104
CategoryVIDEO_PLAYERS	-0.280	0.069	-0.074	-4.079	0.000	-0.415	-0.146
CategoryWEATHER	-0.115	0.079	-0.021	-1.469	0.142	-0.269	0.039
Reviews	0.000	0.000	0.063	6.539	0.000	0.000	0.000
TypePaid	0.063	0.018	0.034	3.538	0.000	0.028	0.098

Forward Selection: Step 4

+ Price

```
                 Model Summary
-----------------------------------------------------------
R                 0.178      RMSE               0.473
R-Squared         0.032      Coef. Var         11.271
Adj. R-Squared    0.028      MSE                0.223
Pred R-Squared    0.026      MAE                0.314
-----------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                      ANOVA
-----------------------------------------------------------
           Sum of
           Squares       DF    Mean Square     F       Sig.
-----------------------------------------------------------
Regression   78.726      35        2.249    10.072    0.0000
Residual   2412.552    10803       0.223
Total      2491.278    10838
-----------------------------------------------------------
```

Screenshot 18

```
                              Parameter Estimates
------------------------------------------------------------------------------------
          model     Beta   Std. Error   Std. Beta      t      Sig    lower    upper
------------------------------------------------------------------------------------
       (Intercept)  4.347     0.059                  74.157   0.000   4.232    4.462
CategoryAUTO_AND_VEHICLES  -0.158  0.078   -0.029     -2.029   0.042  -0.311   -0.005
     CategoryBEAUTY  -0.085    0.087     -0.012       -0.971   0.331  -0.256    0.086
CategoryBOOKS_AND_REFERENCE  -0.044  0.066  -0.013    -0.665   0.506  -0.174    0.086
   CategoryBUSINESS  -0.201    0.063     -0.085       -3.212   0.001  -0.324   -0.078
     CategoryCOMICS  -0.191    0.085     -0.030       -2.258   0.024  -0.357   -0.025
CategoryCOMMUNICATION  -0.209   0.063     -0.081      -3.297   0.001  -0.333   -0.085
     CategoryDATING  -0.341    0.066     -0.103       -5.141   0.000  -0.470   -0.211
  CategoryEDUCATION   0.036    0.070      0.009        0.519   0.604  -0.101    0.173
CategoryENTERTAINMENT  -0.226   0.070    -0.055       -3.218   0.001  -0.364   -0.088
     CategoryEVENTS   0.019    0.083      0.003        0.224   0.823  -0.145    0.182
     CategoryFAMILY  -0.162    0.060     -0.131       -2.725   0.006  -0.279   -0.046
    CategoryFINANCE  -0.205    0.064     -0.077       -3.222   0.001  -0.330   -0.080
CategoryFOOD_AND_DRINK  -0.177  0.072    -0.040       -2.461   0.014  -0.319   -0.036
       CategoryGAME  -0.084    0.060     -0.054       -1.392   0.164  -0.202    0.034
CategoryHEALTH_AND_FITNESS  -0.084  0.064  -0.031     -1.321   0.187  -0.210    0.041
CategoryHOUSE_AND_HOME  -0.150  0.077    -0.028       -1.939   0.052  -0.301    0.002
CategoryLIBRARIES_AND_DEMO  -0.165  0.078  -0.030     -2.114   0.035  -0.317   -0.012
  CategoryLIFESTYLE  -0.233    0.063     -0.090       -3.670   0.000  -0.357   -0.108
CategoryMAPS_AND_NAVIGATION  -0.286  0.071  -0.067    -4.023   0.000  -0.426   -0.147
    CategoryMEDICAL  -0.170    0.063     -0.072       -2.718   0.007  -0.293   -0.048
CategoryNEWS_AND_MAGAZINES  -0.205  0.065  -0.068     -3.161   0.002  -0.333   -0.078
  CategoryPARENTING  -0.066    0.085     -0.010       -0.784   0.433  -0.232    0.100
CategoryPERSONALIZATION  -0.062   0.063   -0.024      -0.979   0.328  -0.186    0.062
CategoryPHOTOGRAPHY  -0.166    0.064     -0.060       -2.588   0.010  -0.291   -0.040
CategoryPRODUCTIVITY  -0.145   0.063     -0.059       -2.302   0.021  -0.268   -0.022
   CategorySHOPPING  -0.098    0.066     -0.031       -1.490   0.136  -0.226    0.031
     CategorySOCIAL  -0.121    0.065     -0.041       -1.865   0.062  -0.248    0.006
     CategorySPORTS  -0.134    0.063     -0.052       -2.113   0.035  -0.258   -0.010
      CategoryTOOLS  -0.290    0.061     -0.162       -4.767   0.000  -0.409   -0.171
CategoryTRAVEL_AND_LOCAL  -0.232  0.066   -0.074      -3.544   0.000  -0.361   -0.104
CategoryVIDEO_PLAYERS  -0.280  0.069     -0.074       -4.077   0.000  -0.414   -0.145
    CategoryWEATHER  -0.116    0.078     -0.021       -1.474   0.141  -0.270    0.038
            Reviews   0.000    0.000      0.063        6.555   0.000   0.000    0.000
           TypePaid   0.074    0.018      0.040        4.047   0.000   0.038    0.110
              Price  -0.001    0.000     -0.026       -2.613   0.009  -0.001    0.000
------------------------------------------------------------------------------------
```

Screenshot 19

Forward Selection: Step 5

+ Size

                        Model Summary

R   0.179   RMSE   0.472
R-Squared   0.032   Coef. Var   11.269
Adj. R-Squared   0.029   MSE   0.223
Pred R-Squared   0.026   MAE   0.314

 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                           ANOVA

             Sum of
             Squares   DF   Mean Square   F   Sig.

Regression   80.129   36   2.226   9.972   0.0000
Residual   2411.149   10802   0.223
Total   2491.278   10838

                      Parameter Estimates
----
              model   Beta   Std. Error   Std. Beta   t   Sig   lower   upper
----
          (Intercept)   4.349   0.059   74.197   0.000   4.234   4.464
 CategoryAUTO_AND_VEHICLES -0.155   0.078   -0.029   -1.996   0.046 -0.308   -0.003
         CategoryBEAUTY   -0.085   0.087   -0.012   -0.968   0.333 -0.256   0.087
CategoryBOOKS_AND_REFERENCE -0.041   0.066   -0.012   -0.620   0.535 -0.171   0.089
       CategoryBUSINESS   -0.199   0.063   -0.084   -3.185   0.001 -0.322   -0.077
         CategoryCOMICS   -0.188   0.085   -0.029   -2.228   0.026 -0.354   -0.023
   CategoryCOMMUNICATION -0.205   0.063   -0.079   -3.232   0.001 -0.329   -0.081
        CategoryDATING   -0.340   0.066   -0.103   -5.133   0.000 -0.470   -0.210
      CategoryEDUCATION   0.038   0.070   0.010   0.549   0.583 -0.098   0.175
   CategoryENTERTAINMENT -0.225   0.070   -0.055   -3.199   0.001 -0.362   -0.087
        CategoryEVENTS   0.020   0.083   0.003   0.236   0.814 -0.143   0.183
        CategoryFAMILY   -0.159   0.060   -0.128   -2.676   0.007 -0.276   -0.043
       CategoryFINANCE   -0.203   0.064   -0.077   -3.193   0.001 -0.328   -0.078
 CategoryFOOD_AND_DRINK   -0.176   0.072   -0.040   -2.443   0.015 -0.317   -0.035 .
          CategoryGAME   -0.080   0.060   -0.051   -1.329   0.184 -0.198   0.038
CategoryHEALTH_AND_FITNESS -0.082   0.064   -0.030   -1.277   0.202 -0.207   0.044
   CategoryHOUSE_AND_HOME -0.148   0.077   -0.028   -1.918   0.055 -0.300   0.003
CategoryLIBRARIES_AND_DEMO -0.144   0.078   -0.026   -1.838   0.066 -0.297   0.010
      CategoryLIFESTYLE   -0.231   0.063   -0.089   -3.636   0.000 -0.355   -0.106
CategoryMAPS_AND_NAVIGATION -0.284   0.071   -0.066   -3.993   0.000 -0.424   -0.145
       CategoryMEDICAL   -0.167   0.063   -0.070   -2.664   0.008 -0.290   -0.044
CategoryNEWS_AND_MAGAZINES -0.205   0.065   -0.068   -3.153   0.002 -0.332   -0.078
      CategoryPARENTING   -0.065   0.085   -0.010   -0.769   0.442 -0.231   0.101
 CategoryPERSONALIZATION -0.059   0.063   -0.023   -0.930   0.353 -0.183   0.065
    CategoryPHOTOGRAPHY   -0.165   0.064   -0.059   -2.571   0.010 -0.290   -0.039
    CategoryPRODUCTIVITY -0.143   0.063   -0.058   -2.264   0.024 -0.266   -0.019

Screenshot 20

Variables Entered:

+ Category
+ Reviews
+ Type
+ Price
+ Size

Final Model Output

                        Model Summary

R   0.179   RMSE   0.472
R-Squared   0.032   Coef. Var   11.269
Adj. R-Squared   0.029   MSE   0.223
Pred R-Squared   0.026   MAE   0.314

 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                           ANOVA

             Sum of
             Squares   DF   Mean Square   F   Sig.

Regression   80.129   36   2.226   9.972   0.0000
Residual   2411.149   10802   0.223
Total   2491.278   10838

Screenshot 21

```
                                    Parameter Estimates
----------------------------------------------------------------------------------------
                    model     Beta    Std. Error   Std. Beta       t      Sig    lower    upper
----------------------------------------------------------------------------------------
               (Intercept)    4.349     0.059                    74.197   0.000   4.234    4.464
  CategoryAUTO_AND_VEHICLES  -0.155     0.078       -0.029       -1.996   0.046  -0.308   -0.003
            CategoryBEAUTY   -0.085     0.087       -0.012       -0.968   0.333  -0.256    0.087
CategoryBOOKS_AND_REFERENCE  -0.041     0.066       -0.012       -0.620   0.535  -0.171    0.089
          CategoryBUSINESS   -0.199     0.063       -0.084       -3.185   0.001  -0.322   -0.077
            CategoryCOMICS   -0.188     0.085       -0.029       -2.228   0.026  -0.354   -0.023
     CategoryCOMMUNICATION   -0.205     0.063       -0.079       -3.232   0.001  -0.329   -0.081
            CategoryDATING   -0.340     0.066       -0.103       -5.133   0.000  -0.470   -0.210
         CategoryEDUCATION    0.038     0.070        0.010        0.549   0.583  -0.098    0.175
     CategoryENTERTAINMENT   -0.225     0.070       -0.055       -3.199   0.001  -0.362   -0.087
            CategoryEVENTS    0.020     0.083        0.003        0.236   0.814  -0.143    0.183
            CategoryFAMILY   -0.159     0.060       -0.128       -2.676   0.007  -0.276   -0.043
           CategoryFINANCE   -0.203     0.064       -0.077       -3.193   0.001  -0.328   -0.078
    CategoryFOOD_AND_DRINK   -0.176     0.072       -0.040       -2.443   0.015  -0.317   -0.035
              CategoryGAME   -0.080     0.060       -0.051       -1.329   0.184  -0.198    0.038
 CategoryHEALTH_AND_FITNESS  -0.082     0.064       -0.030       -1.277   0.202  -0.207    0.044
     CategoryHOUSE_AND_HOME   -0.148     0.077       -0.028       -1.918   0.055  -0.300    0.003
  CategoryLIBRARIES_AND_DEMO  -0.144     0.078       -0.026       -1.838   0.066  -0.297    0.010
          CategoryLIFESTYLE  -0.231     0.063       -0.089       -3.636   0.000  -0.355   -0.106
CategoryMAPS_AND_NAVIGATION  -0.284     0.071       -0.066       -3.993   0.000  -0.424   -0.145
           CategoryMEDICAL   -0.167     0.063       -0.070       -2.664   0.008  -0.290   -0.044
 CategoryNEWS_AND_MAGAZINES  -0.205     0.065       -0.068       -3.153   0.002  -0.332   -0.078
         CategoryPARENTING   -0.065     0.085       -0.010       -0.769   0.442  -0.231    0.101
   CategoryPERSONALIZATION   -0.059     0.063       -0.023       -0.930   0.353  -0.183    0.065
       CategoryPHOTOGRAPHY   -0.165     0.064       -0.059       -2.571   0.010  -0.290   -0.039
      CategoryPRODUCTIVITY   -0.143     0.063       -0.058       -2.264   0.024  -0.266   -0.019
          CategorySHOPPING   -0.095     0.066       -0.030       -1.456   0.145  -0.224    0.033
            CategorySOCIAL   -0.119     0.065       -0.040       -1.839   0.066  -0.246    0.008
            CategorySPORTS   -0.132     0.063       -0.051       -2.078   0.038  -0.256   -0.007
             CategoryTOOLS   -0.286     0.061       -0.160       -4.701   0.000  -0.405   -0.167
   CategoryTRAVEL_AND_LOCAL  -0.231     0.066       -0.073       -3.520   0.000  -0.359   -0.102
     CategoryVIDEO_PLAYERS   -0.279     0.069       -0.073       -4.060   0.000  -0.413   -0.144
           CategoryWEATHER   -0.114     0.078       -0.021       -1.458   0.145  -0.268    0.039
                   Reviews    0.000     0.000        0.064        6.577   0.000   0.000    0.000
                  TypePaid    0.076     0.018        0.042        4.179   0.000   0.041    0.112
                     Price   -0.001     0.000       -0.025       -2.604   0.009  -0.001    0.000
                      Size    0.000     0.000       -0.024       -2.507   0.012   0.000    0.000
----------------------------------------------------------------------------------------


                           Selection Summary
--------------------------------------------------------------------------
         Variable               Adj.
Step     Entered    R-Square   R-Square    C(p)        AIC        RMSE
--------------------------------------------------------------------------
   1     Category    0.0262     0.0233    33.8041    14603.0460   0.4738
   2     Reviews     0.0299     0.0269    -5.3479    14563.9289   0.4729
   3     Type        0.0310     0.0279   -15.8804    14553.3760   0.4727
   4     Price       0.0316     0.0285   -20.7133    14548.5259   0.4726
   5     Size        0.0322     0.0289   -25.0000    14544.2195   0.4725
--------------------------------------------------------------------------
```

Screenshot 21

```
                            Parameter Estimates
---------------------------------------------------------------------------------
                  model     Beta    Std. Error   Std. Beta      t      Sig     lower    upper
---------------------------------------------------------------------------------
            (Intercept)    4.349      0.059                   74.197   0.000    4.234    4.464
 CategoryAUTO_AND_VEHICLES -0.155     0.078       -0.029       -1.996   0.046   -0.308   -0.003
         CategoryBEAUTY    -0.085     0.087       -0.012       -0.968   0.333   -0.256    0.087
CategoryBOOKS_AND_REFERENCE -0.041    0.066       -0.012       -0.620   0.535   -0.171    0.089
       CategoryBUSINESS    -0.199     0.063       -0.084       -3.185   0.001   -0.322   -0.077
         CategoryCOMICS    -0.188     0.085       -0.029       -2.228   0.026   -0.354   -0.023
   CategoryCOMMUNICATION   -0.205     0.063       -0.079       -3.232   0.001   -0.329   -0.081
         CategoryDATING    -0.340     0.066       -0.103       -5.133   0.000   -0.470   -0.210
       CategoryEDUCATION    0.038     0.070        0.010        0.549   0.583   -0.098    0.175
   CategoryENTERTAINMENT   -0.225     0.070       -0.055       -3.199   0.001   -0.362   -0.087
         CategoryEVENTS     0.020     0.083        0.003        0.236   0.814   -0.143    0.183
         CategoryFAMILY    -0.159     0.060       -0.128       -2.676   0.007   -0.276   -0.043
        CategoryFINANCE    -0.203     0.064       -0.077       -3.193   0.001   -0.328   -0.078
  CategoryFOOD_AND_DRINK   -0.176     0.072       -0.040       -2.443   0.015   -0.317   -0.035
           CategoryGAME    -0.080     0.060       -0.051       -1.329   0.184   -0.198    0.038
CategoryHEALTH_AND_FITNESS -0.082     0.064       -0.030       -1.277   0.202   -0.207    0.044
   CategoryHOUSE_AND_HOME  -0.148     0.077       -0.028       -1.918   0.055   -0.300    0.003
 CategoryLIBRARIES_AND_DEMO -0.144    0.078       -0.026       -1.838   0.066   -0.297    0.010
       CategoryLIFESTYLE   -0.231     0.063       -0.089       -3.636   0.000   -0.355   -0.106
CategoryMAPS_AND_NAVIGATION -0.284    0.071       -0.066       -3.993   0.000   -0.424   -0.145
        CategoryMEDICAL    -0.167     0.063       -0.070       -2.664   0.008   -0.290   -0.044
CategoryNEWS_AND_MAGAZINES  -0.205     0.065       -0.068       -3.153   0.002   -0.332   -0.078
      CategoryPARENTING    -0.065     0.085       -0.010       -0.769   0.442   -0.231    0.101
  CategoryPERSONALIZATION  -0.059     0.063       -0.023       -0.930   0.353   -0.183    0.065
     CategoryPHOTOGRAPHY   -0.165     0.064       -0.059       -2.571   0.010   -0.290   -0.039
    CategoryPRODUCTIVITY   -0.143     0.063       -0.058       -2.264   0.024   -0.266   -0.019
       CategorySHOPPING    -0.095     0.066       -0.030       -1.456   0.145   -0.224    0.033
         CategorySOCIAL    -0.119     0.065       -0.040       -1.839   0.066   -0.246    0.008
         CategorySPORTS    -0.132     0.063       -0.051       -2.078   0.038   -0.256   -0.007
          CategoryTOOLS    -0.286     0.061       -0.160       -4.701   0.000   -0.405   -0.167
 CategoryTRAVEL_AND_LOCAL  -0.231     0.066       -0.073       -3.520   0.000   -0.359   -0.102
   CategoryVIDEO_PLAYERS   -0.279     0.069       -0.073       -4.060   0.000   -0.413   -0.144
        CategoryWEATHER    -0.114     0.078       -0.021       -1.458   0.145   -0.268    0.039
                Reviews     0.000     0.000        0.064        6.577   0.000    0.000    0.000
               TypePaid     0.076     0.018        0.042        4.179   0.000    0.041    0.112
                  Price    -0.001     0.000       -0.025       -2.604   0.009   -0.001    0.000
                   Size     0.000     0.000       -0.024       -2.507   0.012    0.000    0.000
---------------------------------------------------------------------------------


                           Selection Summary
----------------------------------------------------------------------
       Variable                 Adj.
Step   Entered   R-Square    R-Square    C(p)        AIC        RMSE
----------------------------------------------------------------------
  1    Category   0.0262      0.0233    33.8041    14603.0460   0.4738
  2    Reviews    0.0299      0.0269    -5.3479    14563.9289   0.4729
  3    Type       0.0310      0.0279   -15.8804    14553.3760   0.4727
  4    Price      0.0316      0.0285   -20.7133    14548.5259   0.4726
  5    Size       0.0322      0.0289   -25.0000    14544.2195   0.4725
----------------------------------------------------------------------
```

Screenshot 22

- *Now we will find the stepwise regression model for backward direction.*

```
> #Performing stepwise backward regression
> ols_step_backward_p(multiple2, details= TRUE)
Backward Elimination Method
---------------------------

candidate Terms:

1 . Category
2 . Type
3 . Size
4 . Price
5 . Reviews

we are eliminating variables based on p value...

No more variables satisfy the condition of p value = 0.3

variables Removed:


Final Model output
------------------

                    Model summary
---------------------------------------------------------------
R                      0.179      RMSE             0.472
R-squared              0.032      Coef. Var       11.269
Adj. R-squared         0.029      MSE              0.223
Pred R-squared         0.026      MAE              0.314
---------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                         ANOVA
---------------------------------------------------------------
              sum of
              squares       DF    Mean Square     F       Sig.
---------------------------------------------------------------
Regression    80.129        36     2.226        9.972    0.0000
Residual    2411.149     10802     0.223
Total       2491.278     10838
---------------------------------------------------------------
```

Screenshot 23

```
                           Parameter Estimates
----------------------------------------------------------------------------------------------
              model     Beta    Std. Error   Std. Beta      t       Sig    lower    upper
----------------------------------------------------------------------------------------------
          (Intercept)   4.349     0.059                  74.197   0.000   4.234    4.464
  CategoryAUTO_AND_VEHICLES  -0.155  0.078     -0.029    -1.996   0.046  -0.308   -0.003
          CategoryBEAUTY     -0.085  0.087     -0.012    -0.968   0.333  -0.256    0.087
CategoryBOOKS_AND_REFERENCE  -0.041  0.066     -0.012    -0.620   0.535  -0.171    0.089
         CategoryBUSINESS    -0.199  0.063     -0.084    -3.185   0.001  -0.322   -0.077
          CategoryCOMICS     -0.188  0.085     -0.029    -2.228   0.026  -0.354   -0.023
    CategoryCOMMUNICATION    -0.205  0.063     -0.079    -3.232   0.001  -0.329   -0.081
         CategoryDATING      -0.340  0.066     -0.103    -5.133   0.000  -0.470   -0.210
       CategoryEDUCATION      0.038  0.070      0.010     0.549   0.583  -0.098    0.175
   CategoryENTERTAINMENT     -0.225  0.070     -0.055    -3.199   0.001  -0.362   -0.087
        CategoryEVENTS        0.020  0.083      0.003     0.236   0.814  -0.143    0.183
        CategoryFAMILY       -0.159  0.060     -0.128    -2.676   0.007  -0.276   -0.043
       CategoryFINANCE       -0.203  0.064     -0.077    -3.193   0.001  -0.328   -0.078
  CategoryFOOD_AND_DRINK     -0.176  0.072     -0.040    -2.443   0.015  -0.317   -0.035
         CategoryGAME        -0.080  0.060     -0.051    -1.329   0.184  -0.198    0.038
 CategoryHEALTH_AND_FITNESS  -0.082  0.064     -0.030    -1.277   0.202  -0.207    0.044
    CategoryHOUSE_AND_HOME   -0.148  0.077     -0.028    -1.918   0.055  -0.300    0.003
 CategoryLIBRARIES_AND_DEMO  -0.144  0.078     -0.026    -1.838   0.066  -0.297    0.010
       CategoryLIFESTYLE     -0.231  0.063     -0.089    -3.636   0.000  -0.355   -0.106
CategoryMAPS_AND_NAVIGATION  -0.284  0.071     -0.066    -3.993   0.000  -0.424   -0.145
        CategoryMEDICAL      -0.167  0.063     -0.070    -2.664   0.008  -0.290   -0.044
CategoryNEWS_AND_MAGAZINES   -0.205  0.065     -0.068    -3.153   0.002  -0.332   -0.078
       CategoryPARENTING     -0.065  0.085     -0.010    -0.769   0.442  -0.231    0.101
 CategoryPERSONALIZATION     -0.059  0.063     -0.023    -0.930   0.353  -0.183    0.065
      CategoryPHOTOGRAPHY    -0.165  0.064     -0.059    -2.571   0.010  -0.290   -0.039
     CategoryPRODUCTIVITY    -0.143  0.063     -0.058    -2.264   0.024  -0.266   -0.019
        CategorySHOPPING     -0.095  0.066     -0.030    -1.456   0.145  -0.224    0.033
         CategorySOCIAL      -0.119  0.065     -0.040    -1.839   0.066  -0.246    0.008
         CategorySPORTS      -0.132  0.063     -0.051    -2.078   0.038  -0.256   -0.007
          CategoryTOOLS      -0.286  0.061     -0.160    -4.701   0.000  -0.405   -0.167
 CategoryTRAVEL_AND_LOCAL    -0.231  0.066     -0.073    -3.520   0.000  -0.359   -0.102
   CategoryVIDEO_PLAYERS     -0.279  0.069     -0.073    -4.060   0.000  -0.413   -0.144
        CategoryWEATHER      -0.114  0.078     -0.021    -1.458   0.145  -0.268    0.039
           TypePaid          0.076  0.018      0.042     4.179   0.000   0.041    0.112
            Size             0.000  0.000     -0.024    -2.507   0.012   0.000    0.000
           Price            -0.001  0.000     -0.025    -2.604   0.009  -0.001    0.000
          Reviews            0.000  0.000      0.064     6.577   0.000   0.000    0.000
----------------------------------------------------------------------------------------------
[1] "No variables have been removed from the model."
```

Screenshot 24

- ***Now we will perform stepwise regression for both the directions.***

```
> ##Performing stepwise both direction regression
> ols_step_both_p(multiple2, details= TRUE)
Stepwise Selection Method
---------------------------

Candidate Terms:

1. Category
2. Type
3. Size
4. Price
5. Reviews

We are selecting variables based on p value...


Stepwise Selection: Step 1

+ Category

                Model Summary
---------------------------------------------------------------
R                    0.162      RMSE              0.474
R-Squared            0.026      Coef. Var        11.301
Adj. R-Squared       0.023      MSE               0.225
Pred R-Squared       0.021      MAE               0.316
---------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                        ANOVA
---------------------------------------------------------------
              Sum of
              Squares      DF    Mean Square     F       Sig.
---------------------------------------------------------------
Regression    65.218       32       2.038       9.078   0.0000
Residual    2426.061    10806       0.225
Total       2491.278    10838
---------------------------------------------------------------
```

Screenshot 25

Parameter Estimates

model	Beta	Std. Error	Std. Beta	t	Sig	lower	upper
(Intercept)	4.351	0.059		74.029	0.000	4.236	4.466
CategoryAUTO_AND_VEHICLES	-0.159	0.078	-0.029	-2.037	0.042	-0.312	-0.006
CategoryBEAUTY	-0.089	0.088	-0.013	-1.009	0.313	-0.260	0.083
CategoryBOOKS_AND_REFERENCE	-0.038	0.067	-0.012	-0.574	0.566	-0.169	0.092
CategoryBUSINESS	-0.203	0.063	-0.085	-3.225	0.001	-0.326	-0.079
CategoryCOMICS	-0.194	0.085	-0.030	-2.288	0.022	-0.360	-0.028
CategoryCOMMUNICATION	-0.186	0.064	-0.072	-2.927	0.003	-0.310	-0.061
CategoryDATING	-0.342	0.066	-0.104	-5.145	0.000	-0.472	-0.212
CategoryEDUCATION	0.037	0.070	0.009	0.530	0.596	-0.100	0.174
CategoryENTERTAINMENT	-0.225	0.070	-0.055	-3.189	0.001	-0.363	-0.087
CategoryEVENTS	0.015	0.083	0.002	0.178	0.859	-0.149	0.178
CategoryFAMILY	-0.158	0.060	-0.127	-2.639	0.008	-0.275	-0.041
CategoryFINANCE	-0.211	0.064	-0.079	-3.307	0.001	-0.336	-0.086
CategoryFOOD_AND_DRINK	-0.179	0.072	-0.040	-2.479	0.013	-0.321	-0.037
CategoryGAME	-0.068	0.060	-0.044	-1.125	0.260	-0.186	0.050
CategoryHEALTH_AND_FITNESS	-0.084	0.064	-0.030	-1.304	0.192	-0.209	0.042
CategoryHOUSE_AND_HOME	-0.153	0.077	-0.029	-1.975	0.048	-0.305	-0.001
CategoryLIBRARIES_AND_DEMO	-0.167	0.078	-0.031	-2.142	0.032	-0.320	-0.014
CategoryLIFESTYLE	-0.237	0.064	-0.091	-3.730	0.000	-0.362	-0.113
CategoryMAPS_AND_NAVIGATION	-0.285	0.071	-0.066	-3.995	0.000	-0.425	-0.145
CategoryMEDICAL	-0.159	0.063	-0.067	-2.533	0.011	-0.282	-0.036
CategoryNEWS_AND_MAGAZINES	-0.207	0.065	-0.069	-3.170	0.002	-0.334	-0.079
CategoryPARENTING	-0.067	0.085	-0.010	-0.795	0.427	-0.234	0.099
CategoryPERSONALIZATION	-0.048	0.063	-0.019	-0.756	0.450	-0.172	0.076
CategoryPHOTOGRAPHY	-0.158	0.064	-0.057	-2.464	0.014	-0.284	-0.032
CategoryPRODUCTIVITY	-0.141	0.063	-0.057	-2.239	0.025	-0.265	-0.018
CategorySHOPPING	-0.096	0.066	-0.031	-1.463	0.143	-0.225	0.033
CategorySOCIAL	-0.102	0.065	-0.035	-1.570	0.116	-0.229	0.025
CategorySPORTS	-0.131	0.064	-0.051	-2.065	0.039	-0.256	-0.007
CategoryTOOLS	-0.284	0.061	-0.158	-4.651	0.000	-0.403	-0.164
CategoryTRAVEL_AND_LOCAL	-0.230	0.066	-0.073	-3.501	0.000	-0.359	-0.101
CategoryVIDEO_PLAYERS	-0.275	0.069	-0.072	-4.001	0.000	-0.410	-0.140
CategoryWEATHER	-0.111	0.079	-0.020	-1.405	0.160	-0.265	0.044

Screenshot 26

Stepwise Selection: Step 2

+ Reviews

```
                         Model Summary
----------------------------------------------------------------
R                   0.173      RMSE              0.473
R-Squared           0.030      Coef. Var        11.280
Adj. R-Squared      0.027      MSE               0.224
Pred R-Squared      0.024      MAE               0.314
----------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

```
                              ANOVA
----------------------------------------------------------------
            Sum of
            Squares       DF    Mean Square     F       Sig.
----------------------------------------------------------------
Regression   74.403       33       2.255      10.08    0.0000
Residual   2416.875     10805      0.224
Total      2491.278     10838
----------------------------------------------------------------
```

```
                        Parameter Estimates
-------------------------------------------------------------------------------------
                 model     Beta   Std. Error   Std. Beta     t      Sig    lower   upper
-------------------------------------------------------------------------------------
           (Intercept)    4.351     0.059                  74.162   0.000   4.236   4.465
  CategoryAUTO_AND_VEHICLES  -0.159   0.078      -0.029     -2.039   0.041  -0.312  -0.006
          CategoryBEAUTY    -0.088     0.088      -0.013     -1.009   0.313  -0.260   0.083
CategoryBOOKS_AND_REFERENCE  -0.039   0.066      -0.012     -0.586   0.558  -0.169   0.091
        CategoryBUSINESS    -0.203     0.063      -0.085     -3.232   0.001  -0.325  -0.080
          CategoryCOMICS    -0.194     0.085      -0.030     -2.296   0.022  -0.360  -0.028
   CategoryCOMMUNICATION    -0.207     0.063      -0.080     -3.261   0.001  -0.331  -0.083
         CategoryDATING    -0.342     0.066      -0.104     -5.155   0.000  -0.472  -0.212
       CategoryEDUCATION     0.035     0.070       0.009      0.498   0.619  -0.102   0.172
   CategoryENTERTAINMENT    -0.228     0.070      -0.055     -3.248   0.001  -0.366  -0.091
         CategoryEVENTS     0.015     0.083       0.002      0.181   0.856  -0.148   0.178
         CategoryFAMILY    -0.159     0.060      -0.128     -2.675   0.007  -0.276  -0.043
        CategoryFINANCE    -0.211     0.064      -0.080     -3.316   0.001  -0.336  -0.086
  CategoryFOOD_AND_DRINK    -0.180     0.072      -0.040     -2.489   0.013  -0.321  -0.038
           CategoryGAME    -0.082     0.060      -0.052     -1.355   0.175  -0.200   0.037
CategoryHEALTH_AND_FITNESS  -0.084    0.064      -0.031     -1.320   0.187  -0.210   0.041
   CategoryHOUSE_AND_HOME    -0.153     0.077      -0.029     -1.981   0.048  -0.305  -0.002
 CategoryLIBRARIES_AND_DEMO  -0.167    0.078      -0.031     -2.144   0.032  -0.320  -0.014
      CategoryLIFESTYLE    -0.237     0.063      -0.091     -3.738   0.000  -0.362  -0.113
CategoryMAPS_AND_NAVIGATION  -0.287   0.071      -0.067     -4.030   0.000  -0.427  -0.147
        CategoryMEDICAL    -0.159     0.063      -0.067     -2.534   0.011  -0.282  -0.036
CategoryNEWS_AND_MAGAZINES  -0.208     0.065      -0.069     -3.202   0.001  -0.336  -0.081
      CategoryPARENTING    -0.067     0.085      -0.010     -0.795   0.427  -0.233   0.099
 CategoryPERSONALIZATION    -0.050     0.063      -0.019     -0.790   0.430  -0.174   0.074
    CategoryPHOTOGRAPHY    -0.164     0.064      -0.059     -2.565   0.010  -0.290  -0.039
    CategoryPRODUCTIVITY    -0.144     0.063      -0.058     -2.283   0.022  -0.267  -0.020
```

Screenshot 27

CategoryPHOTOGRAPHY	-0.164	0.064	-0.059	-2.565	0.010	-0.290	-0.039
CategoryPRODUCTIVITY	-0.144	0.063	-0.058	-2.283	0.022	-0.267	-0.020
CategorySHOPPING	-0.100	0.066	-0.032	-1.530	0.126	-0.229	0.028
CategorySOCIAL	-0.123	0.065	-0.042	-1.896	0.058	-0.250	0.004
CategorySPORTS	-0.133	0.063	-0.051	-2.094	0.036	-0.257	-0.009
CategoryTOOLS	-0.287	0.061	-0.160	-4.709	0.000	-0.406	-0.167
CategoryTRAVEL_AND_LOCAL	-0.232	0.066	-0.074	-3.541	0.000	-0.361	-0.104
CategoryVIDEO_PLAYERS	-0.281	0.069	-0.074	-4.097	0.000	-0.416	-0.147
CategoryWEATHER	-0.112	0.079	-0.020	-1.427	0.154	-0.266	0.042
Reviews	0.000	0.000	0.062	6.408	0.000	0.000	0.000

Model Summary

R	0.173	RMSE	0.473
R-Squared	0.030	Coef. Var	11.280
Adj. R-Squared	0.027	MSE	0.224
Pred R-Squared	0.024	MAE	0.314

RMSE: Root Mean Square Error
MSE: Mean Square Error
MAE: Mean Absolute Error

ANOVA

	Sum of Squares	DF	Mean Square	F	Sig.
Regression	74.403	33	2.255	10.08	0.0000
Residual	2416.875	10805	0.224		
Total	2491.278	10838			

Parameter Estimates

model	Beta	Std. Error	Std. Beta	t	Sig	lower	upper
(Intercept)	4.351	0.059		74.162	0.000	4.236	4.465
CategoryAUTO_AND_VEHICLES	-0.159	0.078	-0.029	-2.039	0.041	-0.312	-0.006
CategoryBEAUTY	-0.088	0.088	-0.013	-1.009	0.313	-0.260	0.083
CategoryBOOKS_AND_REFERENCE	-0.039	0.066	-0.012	-0.586	0.558	-0.169	0.091
CategoryBUSINESS	-0.203	0.063	-0.085	-3.232	0.001	-0.325	-0.080
CategoryCOMICS	-0.194	0.085	-0.030	-2.296	0.022	-0.360	-0.028
CategoryCOMMUNICATION	-0.207	0.063	-0.080	-3.261	0.001	-0.331	-0.083
CategoryDATING	-0.342	0.066	-0.104	-5.155	0.000	-0.472	-0.212
CategoryEDUCATION	0.035	0.070	0.009	0.498	0.619	-0.102	0.172
CategoryENTERTAINMENT	-0.228	0.070	-0.055	-3.248	0.001	-0.366	-0.091
CategoryEVENTS	0.015	0.083	0.002	0.181	0.856	-0.148	0.178
CategoryFAMILY	-0.159	0.060	-0.128	-2.675	0.007	-0.276	-0.043
CategoryFINANCE	0.211	0.064	0.090	3.216	0.001	0.226	0.086

Screenshot 28

```
                CategoryLIFESTYLE    -0.237     0.063    -0.091   -3.738   0.000    -0.362   -0.113
      CategoryMAPS_AND_NAVIGATION    -0.287     0.071    -0.067   -4.030   0.000    -0.427   -0.147
                 CategoryMEDICAL     -0.159     0.063    -0.067   -2.534   0.011    -0.282   -0.036
       CategoryNEWS_AND_MAGAZINES    -0.208     0.065    -0.069   -3.202   0.001    -0.336   -0.081
               CategoryPARENTING     -0.067     0.085    -0.010   -0.795   0.427    -0.233    0.099
          CategoryPERSONALIZATION    -0.050     0.063    -0.019   -0.790   0.430    -0.174    0.074
             CategoryPHOTOGRAPHY     -0.164     0.064    -0.059   -2.565   0.010    -0.290   -0.039
            CategoryPRODUCTIVITY     -0.144     0.063    -0.058   -2.283   0.022    -0.267   -0.020
                CategorySHOPPING     -0.100     0.066    -0.032   -1.530   0.126    -0.229    0.028
                  CategorySOCIAL     -0.123     0.065    -0.042   -1.896   0.058    -0.250    0.004
                 CategorySPORTS     -0.133     0.063    -0.051   -2.094   0.036    -0.257   -0.009
                  CategoryTOOLS     -0.287     0.061    -0.160   -4.709   0.000    -0.406   -0.167
         CategoryTRAVEL_AND_LOCAL    -0.232     0.066    -0.074   -3.541   0.000    -0.361   -0.104
            CategoryVIDEO_PLAYERS    -0.281     0.069    -0.074   -4.097   0.000    -0.416   -0.147
                CategoryWEATHER     -0.112     0.079    -0.020   -1.427   0.154    -0.266    0.042
                         Reviews     0.000     0.000     0.062    6.408   0.000     0.000    0.000
----------------------------------------------------------------------------------------------------


Stepwise Selection: Step 3

+ Type

                      Model Summary
---------------------------------------------------------------
R                        0.176      RMSE               0.473
R-Squared                0.031      Coef. Var         11.274
Adj. R-Squared           0.028      MSE                0.223
Pred R-Squared           0.025      MAE                0.315
---------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                         ANOVA
-----------------------------------------------------------------
              Sum of
              Squares       DF    Mean Square      F       Sig.
-----------------------------------------------------------------
Regression    77.201        34       2.271      10.162   0.0000
Residual    2414.077     10804       0.223
Total       2491.278     10838
-----------------------------------------------------------------

                       Parameter Estimates
------------------------------------------------------------------------------
                    model     Beta   Std. Error   Std. Beta      t     Sig   lower   upper
------------------------------------------------------------------------------
               (Intercept)    4.348     0.059                  74.145  0.000  4.233   4.463
     CategoryAUTO_AND_VEHICLES  -0.158   0.078     -0.029      -2.031  0.042  -0.311  -0.006
                CategoryBEAUTY  -0.085   0.087     -0.012      -0.976  0.329  -0.257   0.086
    CategoryBOOKS_AND_REFERENCE  -0.044   0.066     -0.013      -0.657  0.511  -0.174   0.086
              CategoryBUSINESS  -0.202   0.063     -0.085      -3.218  0.001  -0.324  -0.079
                CategoryCOMICS  -0.192   0.085     -0.030      -2.263  0.024  -0.357  -0.026
```

Screenshot 29

CategoryFAMILY	-0.163	0.060	-0.131	-2.730	0.006	-0.280	-0.046
CategoryFINANCE	-0.211	0.064	-0.080	-3.318	0.001	-0.336	-0.086
CategoryFOOD_AND_DRINK	-0.178	0.072	-0.040	-2.464	0.014	-0.319	-0.036
CategoryGAME	-0.084	0.060	-0.054	-1.388	0.165	-0.202	0.035
CategoryHEALTH_AND_FITNESS	-0.085	0.064	-0.031	-1.321	0.186	-0.210	0.041
CategoryHOUSE_AND_HOME	-0.150	0.077	-0.028	-1.945	0.052	-0.302	0.001
CategoryLIBRARIES_AND_DEMO	-0.165	0.078	-0.030	-2.118	0.034	-0.318	-0.012
CategoryLIFESTYLE	-0.237	0.063	-0.091	-3.744	0.000	-0.362	-0.113
CategoryMAPS_AND_NAVIGATION	-0.287	0.071	-0.067	-4.024	0.000	-0.426	-0.147
CategoryMEDICAL	-0.171	0.063	-0.072	-2.721	0.007	-0.294	-0.048
CategoryNEWS_AND_MAGAZINES	-0.206	0.065	-0.068	-3.166	0.002	-0.333	-0.078
CategoryPARENTING	-0.067	0.085	-0.010	-0.786	0.432	-0.232	0.099
CategoryPERSONALIZATION	-0.060	0.063	-0.024	-0.954	0.340	-0.185	0.064
CategoryPHOTOGRAPHY	-0.166	0.064	-0.060	-2.587	0.010	-0.291	-0.040
CategoryPRODUCTIVITY	-0.145	0.063	-0.059	-2.304	0.021	-0.269	-0.022
CategorySHOPPING	-0.098	0.066	-0.031	-1.496	0.135	-0.227	0.030
CategorySOCIAL	-0.121	0.065	-0.041	-1.869	0.062	-0.248	0.006
CategorySPORTS	-0.134	0.063	-0.052	-2.112	0.035	-0.258	-0.010
CategoryTOOLS	-0.290	0.061	-0.162	-4.760	0.000	-0.409	-0.170
CategoryTRAVEL_AND_LOCAL	-0.232	0.066	-0.074	-3.544	0.000	-0.361	-0.104
CategoryVIDEO_PLAYERS	-0.280	0.069	-0.074	-4.079	0.000	-0.415	-0.146
CategoryWEATHER	-0.115	0.079	-0.021	-1.469	0.142	-0.269	0.039
Reviews	0.000	0.000	0.063	6.539	0.000	0.000	0.000
TypePaid	0.063	0.018	0.034	3.538	0.000	0.028	0.098

```
                  Model Summary
----------------------------------------------------
R                0.176    RMSE          0.473
R-Squared        0.031    Coef. var     11.274
Adj. R-Squared   0.028    MSE           0.223
Pred R-Squared   0.025    MAE           0.315
----------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

ANOVA

	Sum of Squares	DF	Mean Square	F	Sig.
Regression	77.201	34	2.271	10.162	0.0000
Residual	2414.077	10804	0.223		
Total	2491.278	10838			

Parameter Estimates

Screenshot 30

MSE: Mean Square Error
MAE: Mean Absolute Error

ANOVA

	Sum of Squares	DF	Mean Square	F	Sig.
Regression	77.201	34	2.271	10.162	0.0000
Residual	2414.077	10804	0.223		
Total	2491.278	10838			

Parameter Estimates

model	Beta	Std. Error	Std. Beta	t	Sig	lower	upper
(Intercept)	4.348	0.059		74.145	0.000	4.233	4.463
CategoryAUTO_AND_VEHICLES	-0.158	0.078	-0.029	-2.031	0.042	-0.311	-0.006
CategoryBEAUTY	-0.085	0.087	-0.012	-0.976	0.329	-0.257	0.086
CategoryBOOKS_AND_REFERENCE	-0.044	0.066	-0.013	-0.657	0.511	-0.174	0.086
CategoryBUSINESS	-0.202	0.063	-0.085	-3.218	0.001	-0.324	-0.079
CategoryCOMICS	-0.192	0.085	-0.030	-2.263	0.024	-0.357	-0.026
CategoryCOMMUNICATION	-0.209	0.063	-0.081	-3.293	0.001	-0.333	-0.085
CategoryDATING	-0.341	0.066	-0.103	-5.142	0.000	-0.471	-0.211
CategoryEDUCATION	0.036	0.070	0.009	0.516	0.606	-0.101	0.173
CategoryENTERTAINMENT	-0.226	0.070	-0.055	-3.222	0.001	-0.364	-0.089
CategoryEVENTS	0.017	0.083	0.003	0.204	0.838	-0.146	0.180
CategoryFAMILY	-0.163	0.060	-0.131	-2.730	0.006	-0.280	-0.046
CategoryFINANCE	-0.211	0.064	-0.080	-3.318	0.001	-0.336	-0.086
CategoryFOOD_AND_DRINK	-0.178	0.072	-0.040	-2.464	0.014	-0.319	-0.036
CategoryGAME	-0.084	0.060	-0.054	-1.388	0.165	-0.202	0.035
CategoryHEALTH_AND_FITNESS	-0.085	0.064	-0.031	-1.321	0.186	-0.210	0.041
CategoryHOUSE_AND_HOME	-0.150	0.077	-0.028	-1.945	0.052	-0.302	0.001
CategoryLIBRARIES_AND_DEMO	-0.165	0.078	-0.030	-2.118	0.034	-0.318	-0.012
CategoryLIFESTYLE	-0.237	0.063	-0.091	-3.744	0.000	-0.362	-0.113
CategoryMAPS_AND_NAVIGATION	-0.287	0.071	-0.067	-4.024	0.000	-0.426	-0.147
CategoryMEDICAL	-0.171	0.063	-0.072	-2.721	0.007	-0.294	-0.048
CategoryNEWS_AND_MAGAZINES	-0.206	0.065	-0.068	-3.166	0.002	-0.333	-0.078
CategoryPARENTING	-0.067	0.085	-0.010	-0.786	0.432	-0.232	0.099
CategoryPERSONALIZATION	-0.060	0.063	-0.024	-0.954	0.340	-0.185	0.064
CategoryPHOTOGRAPHY	-0.166	0.064	-0.060	-2.587	0.010	-0.291	-0.040
CategoryPRODUCTIVITY	-0.145	0.063	-0.059	-2.304	0.021	-0.269	-0.022
CategorySHOPPING	-0.098	0.066	-0.031	-1.496	0.135	-0.227	0.030
CategorySOCIAL	-0.121	0.065	-0.041	-1.869	0.062	-0.248	0.006
CategorySPORTS	-0.134	0.063	-0.052	-2.112	0.035	-0.258	-0.010
CategoryTOOLS	-0.290	0.061	-0.162	-4.760	0.000	-0.409	-0.170
CategoryTRAVEL_AND_LOCAL	-0.232	0.066	-0.074	-3.544	0.000	-0.361	-0.104
CategoryVIDEO_PLAYERS	-0.280	0.069	-0.074	-4.079	0.000	-0.415	-0.146
CategoryWEATHER	-0.115	0.079	-0.021	-1.469	0.142	-0.269	0.039
Reviews	0.000	0.000	0.063	6.539	0.000	0.000	0.000
TypePaid	0.063	0.018	0.034	3.538	0.000	0.028	0.098

Screenshot 31

```
Stepwise Selection: Step 4

+ Price
                          Model Summary
-------------------------------------------------------------
R                      0.178     RMSE                0.473
R-Squared              0.032     Coef. Var          11.271
Adj. R-Squared         0.028     MSE                 0.223
Pred R-Squared         0.026     MAE                 0.314
-------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error

                          ANOVA
-------------------------------------------------------------
             Sum of
             Squares      DF    Mean Square    F       Sig.
-------------------------------------------------------------
Regression   78.726       35       2.249     10.072   0.0000
Residual     2412.552    10803      0.223
Total        2491.278    10838
-------------------------------------------------------------

                       Parameter Estimates
-----------------------------------------------------------------------------
              model      Beta    Std. Error   Std. Beta    t       Sig    lower    upper
-----------------------------------------------------------------------------
          (Intercept)    4.347     0.059                  74.157   0.000   4.232    4.462
 CategoryAUTO_AND_VEHICLES  -0.158  0.078      -0.029     -2.029   0.042  -0.311   -0.005
          CategoryBEAUTY   -0.085    0.087      -0.012     -0.971   0.331  -0.256    0.086
CategoryBOOKS_AND_REFERENCE  -0.044  0.066      -0.013     -0.665   0.506  -0.174    0.086
        CategoryBUSINESS   -0.201    0.063      -0.085     -3.212   0.001  -0.324   -0.078
          CategoryCOMICS   -0.191    0.085      -0.030     -2.258   0.024  -0.357   -0.025
   CategoryCOMMUNICATION   -0.209    0.063      -0.081     -3.297   0.001  -0.333   -0.085
         CategoryDATING    -0.341    0.066      -0.103     -5.141   0.000  -0.470   -0.211
       CategoryEDUCATION    0.036    0.070       0.009      0.519   0.604  -0.101    0.173
   CategoryENTERTAINMENT   -0.226    0.070      -0.055     -3.218   0.001  -0.364   -0.088
          CategoryEVENTS    0.019    0.083       0.003      0.224   0.823  -0.145    0.182
          CategoryFAMILY   -0.162    0.060      -0.131     -2.725   0.006  -0.279   -0.046
         CategoryFINANCE   -0.205    0.064      -0.077     -3.222   0.001  -0.330   -0.080
   CategoryFOOD_AND_DRINK   -0.177    0.072      -0.040     -2.461   0.014  -0.319   -0.036
           CategoryGAME    -0.084    0.060      -0.054     -1.392   0.164  -0.202    0.034
CategoryHEALTH_AND_FITNESS  -0.084   0.064      -0.031     -1.321   0.187  -0.210    0.041
   CategoryHOUSE_AND_HOME   -0.150    0.077      -0.028     -1.939   0.052  -0.301    0.002
CategoryLIBRARIES_AND_DEMO  -0.165   0.078      -0.030     -2.114   0.035  -0.317   -0.012
       CategoryLIFESTYLE   -0.233    0.063      -0.090     -3.670   0.000  -0.357   -0.108
CategoryMAPS_AND_NAVIGATION  -0.286  0.071      -0.067     -4.023   0.000  -0.426   -0.147
         CategoryMEDICAL   -0.170    0.063      -0.072     -2.718   0.007  -0.293   -0.048
 CategoryNEWS_AND_MAGAZINES  -0.205   0.065      -0.068     -3.161   0.002  -0.333   -0.078
       CategoryPARENTING   -0.066    0.085      -0.010     -0.784   0.433  -0.232    0.100
  CategoryPERSONALIZATION   -0.062    0.063      -0.024     -0.979   0.328  -0.186    0.062
      CategoryPHOTOGRAPHY   -0.166    0.064      -0.060     -2.588   0.010  -0.291   -0.040
```

Screenshot 32

model	Beta	Std. Error	Std. Beta	t	Sig	lower	upper
CategoryNEWS_AND_MAGAZINES	-0.205	0.065	-0.068	-3.161	0.002	-0.333	-0.078
CategoryPARENTING	-0.066	0.085	-0.010	-0.784	0.433	-0.232	0.100
CategoryPERSONALIZATION	-0.062	0.063	-0.024	-0.979	0.328	-0.186	0.062
CategoryPHOTOGRAPHY	-0.166	0.064	-0.060	-2.588	0.010	-0.291	-0.040
CategoryPRODUCTIVITY	-0.145	0.063	-0.059	-2.302	0.021	-0.268	-0.022
CategorySHOPPING	-0.098	0.066	-0.031	-1.490	0.136	-0.226	0.031
CategorySOCIAL	-0.121	0.065	-0.041	-1.865	0.062	-0.248	0.006
CategorySPORTS	-0.134	0.063	-0.052	-2.113	0.035	-0.258	-0.010
CategoryTOOLS	-0.290	0.061	-0.162	-4.767	0.000	-0.409	-0.171
CategoryTRAVEL_AND_LOCAL	-0.232	0.066	-0.074	-3.544	0.000	-0.361	-0.104
CategoryVIDEO_PLAYERS	-0.280	0.069	-0.074	-4.077	0.000	-0.414	-0.145
CategoryWEATHER	-0.116	0.078	-0.021	-1.474	0.141	-0.270	0.038
Reviews	0.000	0.000	0.063	6.555	0.000	0.000	0.000
TypePaid	0.074	0.018	0.040	4.047	0.000	0.038	0.110
Price	-0.001	0.000	-0.026	-2.613	0.009	-0.001	0.000

Model Summary

R	0.178	RMSE	0.473
R-Squared	0.032	Coef. Var	11.271
Adj. R-Squared	0.028	MSE	0.223
Pred R-Squared	0.026	MAE	0.314

RMSE: Root Mean Square Error
MSE: Mean Square Error
MAE: Mean Absolute Error

ANOVA

	Sum of Squares	DF	Mean Square	F	Sig.
Regression	78.726	35	2.249	10.072	0.0000
Residual	2412.552	10803	0.223		
Total	2491.278	10838			

Parameter Estimates

model	Beta	Std. Error	Std. Beta	t	Sig	lower	upper
(Intercept)	4.347	0.059		74.157	0.000	4.232	4.462
CategoryAUTO_AND_VEHICLES	-0.158	0.078	-0.029	-2.029	0.042	-0.311	-0.005
CategoryBEAUTY	-0.085	0.087	-0.012	-0.971	0.331	-0.256	0.086
CategoryBOOKS_AND_REFERENCE	-0.044	0.066	-0.013	-0.665	0.506	-0.174	0.086
CategoryBUSINESS	-0.201	0.063	-0.085	-3.212	0.001	-0.324	-0.078
CategoryCOMICS	-0.191	0.085	-0.030	-2.258	0.024	-0.357	-0.025
CategoryCOMMUNICATION	-0.209	0.063	-0.081	-3.297	0.001	-0.333	-0.085
CategoryDATING	-0.341	0.066	-0.103	-5.141	0.000	-0.470	-0.211
CategoryEDUCATION	0.036	0.070	0.009	0.519	0.604	-0.101	0.173

Screenshot 33

CategoryFAMILY	-0.162	0.060	-0.131	-2.725	0.006	-0.279	-0.046
CategoryFINANCE	-0.205	0.064	-0.077	-3.222	0.001	-0.330	-0.080
CategoryFOOD_AND_DRINK	-0.177	0.072	-0.040	-2.461	0.014	-0.319	-0.036
CategoryGAME	-0.084	0.060	-0.054	-1.392	0.164	-0.202	0.034
CategoryHEALTH_AND_FITNESS	-0.084	0.064	-0.031	-1.321	0.187	-0.210	0.041
CategoryHOUSE_AND_HOME	-0.150	0.077	-0.028	-1.939	0.052	-0.301	0.002
CategoryLIBRARIES_AND_DEMO	-0.165	0.078	-0.030	-2.114	0.035	-0.317	-0.012
CategoryLIFESTYLE	-0.233	0.063	-0.090	-3.670	0.000	-0.357	-0.108
CategoryMAPS_AND_NAVIGATION	-0.286	0.071	-0.067	-4.023	0.000	-0.426	-0.147
CategoryMEDICAL	-0.170	0.063	-0.072	-2.718	0.007	-0.293	-0.048
CategoryNEWS_AND_MAGAZINES	-0.205	0.065	-0.068	-3.161	0.002	-0.333	-0.078
CategoryPARENTING	-0.066	0.085	-0.010	-0.784	0.433	-0.232	0.100
CategoryPERSONALIZATION	-0.062	0.063	-0.024	-0.979	0.328	-0.186	0.062
CategoryPHOTOGRAPHY	-0.166	0.064	-0.060	-2.588	0.010	-0.291	-0.040
CategoryPRODUCTIVITY	-0.145	0.063	-0.059	-2.302	0.021	-0.268	-0.022
CategorySHOPPING	-0.098	0.066	-0.031	-1.490	0.136	-0.226	0.031
CategorySOCIAL	-0.121	0.065	-0.041	-1.865	0.062	-0.248	0.006
CategorySPORTS	-0.134	0.063	-0.052	-2.113	0.035	-0.258	-0.010
CategoryTOOLS	-0.290	0.061	-0.162	-4.767	0.000	-0.409	-0.171
CategoryTRAVEL_AND_LOCAL	-0.232	0.066	-0.074	-3.544	0.000	-0.361	-0.104
CategoryVIDEO_PLAYERS	-0.280	0.069	-0.074	-4.077	0.000	-0.414	-0.145
CategoryWEATHER	-0.116	0.078	-0.021	-1.474	0.141	-0.270	0.038
Reviews	0.000	0.000	0.063	6.555	0.000	0.000	0.000
TypePaid	0.074	0.018	0.040	4.047	0.000	0.038	0.110
Price	-0.001	0.000	-0.026	-2.613	0.009	-0.001	0.000

Stepwise Selection: Step 5

+ Size

```
                    Model Summary
------------------------------------------------------------
R                   0.179    RMSE              0.472
R-Squared           0.032    Coef. Var        11.269
Adj. R-Squared      0.029    MSE               0.223
Pred R-Squared      0.026    MAE               0.314
------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

	Sum of Squares	DF	Mean Square	F	Sig.
			ANOVA		
Regression	80.129	36	2.226	9.972	0.0000
Residual	2411.149	10802	0.223		
Total	2491.278	10838			

Screenshot 34

```
------------------------------------------------------------------------------------------
              model      Beta    Std. Error    Std. Beta        t      Sig    lower    upper
------------------------------------------------------------------------------------------
          (Intercept)    4.349     0.059                      74.197   0.000   4.234    4.464
CategoryAUTO_AND_VEHICLES -0.155   0.078        -0.029        -1.996   0.046  -0.308   -0.003
        CategoryBEAUTY   -0.085    0.087        -0.012        -0.968   0.333  -0.256    0.087
CategoryBOOKS_AND_REFERENCE -0.041 0.066        -0.012        -0.620   0.535  -0.171    0.089
      CategoryBUSINESS   -0.199    0.063        -0.084        -3.185   0.001  -0.322   -0.077
        CategoryCOMICS   -0.188    0.085        -0.029        -2.228   0.026  -0.354   -0.023
  CategoryCOMMUNICATION  -0.205    0.063        -0.079        -3.232   0.001  -0.329   -0.081
        CategoryDATING   -0.340    0.066        -0.103        -5.133   0.000  -0.470   -0.210
     CategoryEDUCATION    0.038    0.070         0.010         0.549   0.583  -0.098    0.175
  CategoryENTERTAINMENT  -0.225    0.070        -0.055        -3.199   0.001  -0.362   -0.087
        CategoryEVENTS    0.020    0.083         0.003         0.236   0.814  -0.143    0.183
        CategoryFAMILY   -0.159    0.060        -0.128        -2.676   0.007  -0.276   -0.043
       CategoryFINANCE   -0.203    0.064        -0.077        -3.193   0.001  -0.328   -0.078
 CategoryFOOD_AND_DRINK  -0.176    0.072        -0.040        -2.443   0.015  -0.317   -0.035
          CategoryGAME   -0.080    0.060        -0.051        -1.329   0.184  -0.198    0.038
CategoryHEALTH_AND_FITNESS -0.082  0.064        -0.030        -1.277   0.202  -0.207    0.044
  CategoryHOUSE_AND_HOME  -0.148   0.077        -0.028        -1.918   0.055  -0.300    0.003
CategoryLIBRARIES_AND_DEMO -0.144  0.078        -0.026        -1.838   0.066  -0.297    0.010
     CategoryLIFESTYLE   -0.231    0.063        -0.089        -3.636   0.000  -0.355   -0.106
CategoryMAPS_AND_NAVIGATION -0.284 0.071        -0.066        -3.993   0.000  -0.424   -0.145
       CategoryMEDICAL   -0.167    0.063        -0.070        -2.664   0.008  -0.290   -0.044
CategoryNEWS_AND_MAGAZINES -0.205  0.065        -0.068        -3.153   0.002  -0.332   -0.078
     CategoryPARENTING   -0.065    0.085        -0.010        -0.769   0.442  -0.231    0.101
CategoryPERSONALIZATION  -0.059    0.063        -0.023        -0.930   0.353  -0.183    0.065
    CategoryPHOTOGRAPHY  -0.165    0.064        -0.059        -2.571   0.010  -0.290   -0.039
   CategoryPRODUCTIVITY  -0.143    0.063        -0.058        -2.264   0.024  -0.266   -0.019
      CategorySHOPPING   -0.095    0.066        -0.030        -1.456   0.145  -0.224    0.033
        CategorySOCIAL   -0.119    0.065        -0.040        -1.839   0.066  -0.246    0.008
        CategorySPORTS   -0.132    0.063        -0.051        -2.078   0.038  -0.256   -0.007
         CategoryTOOLS   -0.286    0.061        -0.160        -4.701   0.000  -0.405   -0.167
CategoryTRAVEL_AND_LOCAL -0.231    0.066        -0.073        -3.520   0.000  -0.359   -0.102
  CategoryVIDEO_PLAYERS  -0.279    0.069        -0.073        -4.060   0.000  -0.413   -0.144
       CategoryWEATHER   -0.114    0.078        -0.021        -1.458   0.145  -0.268    0.039
               Reviews    0.000    0.000         0.064         6.577   0.000   0.000    0.000
              TypePaid    0.076    0.018         0.042         4.179   0.000   0.041    0.112
                 Price   -0.001    0.000        -0.025        -2.604   0.009  -0.001    0.000
                  Size    0.000    0.000        -0.024        -2.507   0.012   0.000    0.000
------------------------------------------------------------------------------------------


                     Model Summary
--------------------------------------------------------------
R                   0.179      RMSE            0.472
R-Squared           0.032      Coef. Var      11.269
Adj. R-Squared      0.029      MSE             0.223
Pred R-Squared      0.026      MAE             0.314
--------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

Screenshot 35

```
                              ANOVA
---------------------------------------------------------------
              Sum of
              Squares      DF    Mean Square    F       Sig.
---------------------------------------------------------------
Regression    80.129       36       2.226      9.972    0.0000
Residual      2411.149     10802    0.223
Total         2491.278     10838
---------------------------------------------------------------


                        Parameter Estimates
-----------------------------------------------------------------------------------
           model       Beta   Std. Error   Std. Beta     t      Sig    lower   upper
-----------------------------------------------------------------------------------
            (Intercept)  4.349    0.059                 74.197  0.000   4.234   4.464
 CategoryAUTO_AND_VEHICLES -0.155  0.078     -0.029     -1.996  0.046  -0.308  -0.003
          CategoryBEAUTY  -0.085   0.087     -0.012     -0.968  0.333  -0.256   0.087
CategoryBOOKS_AND_REFERENCE -0.041 0.066     -0.012     -0.620  0.535  -0.171   0.089
        CategoryBUSINESS  -0.199   0.063     -0.084     -3.185  0.001  -0.322  -0.077
          CategoryCOMICS  -0.188   0.085     -0.029     -2.228  0.026  -0.354  -0.023
   CategoryCOMMUNICATION  -0.205   0.063     -0.079     -3.232  0.001  -0.329  -0.081
          CategoryDATING  -0.340   0.066     -0.103     -5.133  0.000  -0.470  -0.210
       CategoryEDUCATION   0.038   0.070      0.010      0.549  0.583  -0.098   0.175
   CategoryENTERTAINMENT  -0.225   0.070     -0.055     -3.199  0.001  -0.362  -0.087
          CategoryEVENTS   0.020   0.083      0.003      0.236  0.814  -0.143   0.183
          CategoryFAMILY  -0.159   0.060     -0.128     -2.676  0.007  -0.276  -0.043
         CategoryFINANCE  -0.203   0.064     -0.077     -3.193  0.001  -0.328  -0.078
  CategoryFOOD_AND_DRINK  -0.176   0.072     -0.040     -2.443  0.015  -0.317  -0.035
            CategoryGAME  -0.080   0.060     -0.051     -1.329  0.184  -0.198   0.038
CategoryHEALTH_AND_FITNESS -0.082  0.064     -0.030     -1.277  0.202  -0.207   0.044
   CategoryHOUSE_AND_HOME  -0.148  0.077     -0.028     -1.918  0.055  -0.300   0.003
 CategoryLIBRARIES_AND_DEMO -0.144 0.078     -0.026     -1.838  0.066  -0.297   0.010
       CategoryLIFESTYLE  -0.231   0.063     -0.089     -3.636  0.000  -0.355  -0.106
CategoryMAPS_AND_NAVIGATION -0.284 0.071     -0.066     -3.993  0.000  -0.424  -0.145
         CategoryMEDICAL  -0.167   0.063     -0.070     -2.664  0.008  -0.290  -0.044
CategoryNEWS_AND_MAGAZINES -0.205  0.065     -0.068     -3.153  0.002  -0.332  -0.078
       CategoryPARENTING  -0.065   0.085     -0.010     -0.769  0.442  -0.231   0.101
  CategoryPERSONALIZATION  -0.059  0.063     -0.023     -0.930  0.353  -0.183   0.065
      CategoryPHOTOGRAPHY  -0.165  0.064     -0.059     -2.571  0.010  -0.290  -0.039
     CategoryPRODUCTIVITY  -0.143  0.063     -0.058     -2.264  0.024  -0.266  -0.019
        CategorySHOPPING  -0.095   0.066     -0.030     -1.456  0.145  -0.224   0.033
          CategorySOCIAL  -0.119   0.065     -0.040     -1.839  0.066  -0.246   0.008
          CategorySPORTS  -0.132   0.063     -0.051     -2.078  0.038  -0.256  -0.007
           CategoryTOOLS  -0.286   0.061     -0.160     -4.701  0.000  -0.405  -0.167
 CategoryTRAVEL_AND_LOCAL  -0.231  0.066     -0.073     -3.520  0.000  -0.359  -0.102
   CategoryVIDEO_PLAYERS  -0.279   0.069     -0.073     -4.060  0.000  -0.413  -0.144
         CategoryWEATHER  -0.114   0.078     -0.021     -1.458  0.145  -0.268   0.039
                 Reviews   0.000   0.000      0.064      6.577  0.000   0.000   0.000
                TypePaid   0.076   0.018      0.042      4.179  0.000   0.041   0.112
                   Price  -0.001   0.000     -0.025     -2.604  0.009  -0.001   0.000
                    Size   0.000   0.000     -0.024     -2.507  0.012   0.000   0.000
-----------------------------------------------------------------------------------
```

Screenshot 36

Final Model Output

```
                         Model Summary
-----------------------------------------------------------------
R                        0.179    RMSE              0.472
R-Squared                0.032    Coef. Var        11.269
Adj. R-Squared           0.029    MSE               0.223
Pred R-Squared           0.026    MAE               0.314
-----------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

```
                              ANOVA
-----------------------------------------------------------------
               Sum of
               Squares     DF     Mean Square    F       Sig.
-----------------------------------------------------------------
Regression      80.129      36       2.226      9.972    0.0000
Residual      2411.149   10802       0.223
Total         2491.278   10838
-----------------------------------------------------------------
```

```
                         Parameter Estimates
-------------------------------------------------------------------------------------------
                 model     Beta    Std. Error   Std. Beta     t      Sig    lower    upper
-------------------------------------------------------------------------------------------
             (Intercept)   4.349     0.059                  74.197   0.000   4.234    4.464
  CategoryAUTO_AND_VEHICLES  -0.155  0.078       -0.029     -1.996   0.046  -0.308   -0.003
           CategoryBEAUTY  -0.085    0.087       -0.012     -0.968   0.333  -0.256    0.087
CategoryBOOKS_AND_REFERENCE  -0.041  0.066       -0.012     -0.620   0.535  -0.171    0.089
         CategoryBUSINESS  -0.199    0.063       -0.084     -3.185   0.001  -0.322   -0.077
           CategoryCOMICS  -0.188    0.085       -0.029     -2.228   0.026  -0.354   -0.023
    CategoryCOMMUNICATION  -0.205    0.063       -0.079     -3.232   0.001  -0.329   -0.081
          CategoryDATING   -0.340    0.066       -0.103     -5.133   0.000  -0.470   -0.210
        CategoryEDUCATION   0.038    0.070        0.010      0.549   0.583  -0.098    0.175
    CategoryENTERTAINMENT  -0.225    0.070       -0.055     -3.199   0.001  -0.362   -0.087
           CategoryEVENTS   0.020    0.083        0.003      0.236   0.814  -0.143    0.183
           CategoryFAMILY  -0.159    0.060       -0.128     -2.676   0.007  -0.276   -0.043
          CategoryFINANCE  -0.203    0.064       -0.077     -3.193   0.001  -0.328   -0.078
   CategoryFOOD_AND_DRINK  -0.176    0.072       -0.040     -2.443   0.015  -0.317   -0.035
             CategoryGAME  -0.080    0.060       -0.051     -1.329   0.184  -0.198    0.038
 CategoryHEALTH_AND_FITNESS -0.082   0.064       -0.030     -1.277   0.202  -0.207    0.044
    CategoryHOUSE_AND_HOME  -0.148   0.077       -0.028     -1.918   0.055  -0.300    0.003
 CategoryLIBRARIES_AND_DEMO  -0.144  0.078       -0.026     -1.838   0.066  -0.297    0.010
        CategoryLIFESTYLE  -0.231    0.063       -0.089     -3.636   0.000  -0.355   -0.106
CategoryMAPS_AND_NAVIGATION  -0.284  0.071       -0.066     -3.993   0.000  -0.424   -0.145
          CategoryMEDICAL  -0.167    0.063       -0.070     -2.664   0.008  -0.290   -0.044
 CategoryNEWS_AND_MAGAZINES  -0.205  0.065       -0.068     -3.153   0.002  -0.332   -0.078
        CategoryPARENTING  -0.065    0.085       -0.010     -0.769   0.442  -0.231    0.101
  CategoryPERSONALIZATION  -0.059    0.063       -0.023     -0.930   0.353  -0.183    0.065
      CategoryPHOTOGRAPHY  -0.165    0.064       -0.059     -2.571   0.010  -0.290   -0.039
     CategoryPRODUCTIVITY  -0.143    0.063       -0.058     -2.264   0.024  -0.266   -0.019
         CategorySHOPPING  -0.095    0.066       -0.030     -1.456   0.145  -0.224    0.033
           CategorySOCIAL  -0.119    0.065       -0.040     -1.839   0.066  -0.246    0.008
```

Screenshot 37

```
     CategoryPRODUCTIVITY  -0.143    0.063       -0.058     -2.264   0.024  -0.266   -0.019
         CategorySHOPPING  -0.095    0.066       -0.030     -1.456   0.145  -0.224    0.033
           CategorySOCIAL  -0.119    0.065       -0.040     -1.839   0.066  -0.246    0.008
          CategorySPORTS   -0.132    0.063       -0.051     -2.078   0.038  -0.256   -0.007
            CategoryTOOLS  -0.286    0.061       -0.160     -4.701   0.000  -0.405   -0.167
 CategoryTRAVEL_AND_LOCAL  -0.231    0.066       -0.073     -3.520   0.000  -0.359   -0.102
    CategoryVIDEO_PLAYERS  -0.279    0.069       -0.073     -4.060   0.000  -0.413   -0.144
          CategoryWEATHER  -0.114    0.078       -0.021     -1.458   0.145  -0.268    0.039
                  Reviews   0.000    0.000        0.064      6.577   0.000   0.000    0.000
                 TypePaid   0.076    0.018        0.042      4.179   0.000   0.041    0.112
                    Price  -0.001    0.000       -0.025     -2.604   0.009  -0.001    0.000
                     Size   0.000    0.000       -0.024     -2.507   0.012   0.000    0.000
---------------------------------------------------------------------------------------------
```

```
                         Stepwise Selection Summary
---------------------------------------------------------------------------------
                   Added/              Adj.
Step    Variable   Removed   R-Square  R-Square   C(p)       AIC        RMSE
---------------------------------------------------------------------------------
  1     Category   addition   0.026     0.023     33.8040   14603.0460  0.4738
  2     Reviews    addition   0.030     0.027     -5.3480   14563.9289  0.4729
  3     Type       addition   0.031     0.028    -15.8800   14553.3760  0.4727
  4     Price      addition   0.032     0.028    -20.7130   14548.5259  0.4726
  5     Size       addition   0.032     0.029    -25.0000   14544.2195  0.4725
---------------------------------------------------------------------------------
> |
```

Screenshot 38

```
> ols_step_forward_aic(multiple2, details= TRUE)
Forward Selection Method
--------------------------

Candidate Terms:

1 . Category
2 . Type
3 . Size
4 . Price
5 . Reviews

 Step 0: AIC = 14826.57
 Rating ~ 1
```

Variable	DF	AIC	Sum Sq	RSS	R-Sq	Adj. R-Sq
Category	1	14603.046	65.218	2426.061	0.026	0.023
Reviews	1	14778.848	11.403	2479.875	0.005	0.004
Type	1	14814.490	3.235	2488.043	0.001	0.001
Price	1	14824.204	1.004	2490.274	0.000	0.000
Size	1	14824.602	0.913	2490.366	0.000	0.000

```
+ Category


 Step 1 : AIC = 14603.05
 Rating ~ Category
```

Variable	DF	AIC	Sum Sq	RSS	R-Sq	Adj. R-Sq
Reviews	1	14563.929	9.186	2416.875	0.030	0.027
Type	1	14594.192	2.428	2423.632	0.027	0.024
Size	1	14599.888	1.154	2424.906	0.027	0.024
Price	1	14602.004	0.681	2425.380	0.026	0.023

```
+ Reviews


 Step 2 : AIC = 14563.93
 Rating ~ Category + Reviews
```

Variable	DF	AIC	Sum Sq	RSS	R-Sq	Adj. R-Sq
Type	1	14553.376	2.797	2414.077	0.031	0.028
Size	1	14560.575	1.193	2415.681	0.030	0.027
Price	1	14562.950	0.664	2416.211	0.030	0.027

Screenshot 39

```
+ Type


 Step 3 : AIC = 14553.38
 Rating ~ Category + Reviews + Type


------------------------------------------------------------------------
Variable      DF       AIC       Sum Sq      RSS       R-Sq     Adj. R-Sq
------------------------------------------------------------------------
Price         1     14548.526    1.525     2412.552    0.032       0.028
Size          1     14549.023    1.415     2412.663    0.032       0.028
------------------------------------------------------------------------

+ Price


 Step 4 : AIC = 14548.53
 Rating ~ Category + Reviews + Type + Price


------------------------------------------------------------------------
Variable      DF       AIC       Sum Sq      RSS       R-Sq     Adj. R-Sq
------------------------------------------------------------------------
Size          1     14544.219    1.403     2411.149    0.032       0.029
------------------------------------------------------------------------

+ Size


Variables Entered:

+ Category
+ Reviews
+ Type
+ Price
+ Size


Final Model Output
------------------

                       Model Summary
------------------------------------------------------------
R                    0.179      RMSE               0.472
R-Squared            0.032      Coef. Var         11.269
Adj. R-Squared       0.029      MSE                0.223
Pred R-Squared       0.026      MAE                0.314
------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

Screenshot 40

```
                              ANOVA
--------------------------------------------------------------
          Sum of
          Squares        DF    Mean Square      F       Sig.
--------------------------------------------------------------
Regression  80.129        36        2.226     9.972    0.0000
Residual  2411.149     10802        0.223
Total     2491.278     10838
--------------------------------------------------------------


                        Parameter Estimates
----------------------------------------------------------------------------------------
              model      Beta   Std. Error   Std. Beta      t       sig     lower   upper
----------------------------------------------------------------------------------------
           (Intercept)   4.349     0.059                  74.197    0.000    4.234   4.464
 CategoryAUTO_AND_VEHICLES  -0.155  0.078     -0.029      -1.996    0.046   -0.308  -0.003
           CategoryBEAUTY  -0.085   0.087     -0.012      -0.968    0.333   -0.256   0.087
CategoryBOOKS_AND_REFERENCE -0.041  0.066     -0.012      -0.620    0.535   -0.171   0.089
         CategoryBUSINESS  -0.199   0.063     -0.084      -3.185    0.001   -0.322  -0.077
           CategoryCOMICS  -0.188   0.085     -0.029      -2.228    0.026   -0.354  -0.023
    CategoryCOMMUNICATION  -0.205   0.063     -0.079      -3.232    0.001   -0.329  -0.081
           CategoryDATING  -0.340   0.066     -0.103      -5.133    0.000   -0.470  -0.210
        CategoryEDUCATION   0.038   0.070      0.010       0.549    0.583   -0.098   0.175
    CategoryENTERTAINMENT  -0.225   0.070     -0.055      -3.199    0.001   -0.362  -0.087
           CategoryEVENTS   0.020   0.083      0.003       0.236    0.814   -0.143   0.183
           CategoryFAMILY  -0.159   0.060     -0.128      -2.676    0.007   -0.276  -0.043
          CategoryFINANCE  -0.203   0.064     -0.077      -3.193    0.001   -0.328  -0.078
   CategoryFOOD_AND_DRINK  -0.176   0.072     -0.040      -2.443    0.015   -0.317  -0.035
             CategoryGAME  -0.080   0.060     -0.051      -1.329    0.184   -0.198   0.038
 CategoryHEALTH_AND_FITNESS -0.082  0.064     -0.030      -1.277    0.202   -0.207   0.044
   CategoryHOUSE_AND_HOME  -0.148   0.077     -0.028      -1.918    0.055   -0.300   0.003
 CategoryLIBRARIES_AND_DEMO -0.144  0.078     -0.026      -1.838    0.066   -0.297   0.010
        CategoryLIFESTYLE  -0.231   0.063     -0.089      -3.636    0.000   -0.355  -0.106
CategoryMAPS_AND_NAVIGATION -0.284  0.071     -0.066      -3.993    0.000   -0.424  -0.145
          CategoryMEDICAL  -0.167   0.063     -0.070      -2.664    0.008   -0.290  -0.044
 CategoryNEWS_AND_MAGAZINES -0.205  0.065     -0.068      -3.153    0.002   -0.332  -0.078
        CategoryPARENTING  -0.065   0.085     -0.010      -0.769    0.442   -0.231   0.101
  CategoryPERSONALIZATION  -0.059   0.063     -0.023      -0.930    0.353   -0.183   0.065
      CategoryPHOTOGRAPHY  -0.165   0.064     -0.059      -2.571    0.010   -0.290  -0.039
     CategoryPRODUCTIVITY  -0.143   0.063     -0.058      -2.264    0.024   -0.266  -0.019
         CategorySHOPPING  -0.095   0.066     -0.030      -1.456    0.145   -0.224   0.033
           CategorySOCIAL  -0.119   0.065     -0.040      -1.839    0.066   -0.246   0.008
           CategorySPORTS  -0.132   0.063     -0.051      -2.078    0.038   -0.256  -0.007
            CategoryTOOLS  -0.286   0.061     -0.160      -4.701    0.000   -0.405  -0.167
 CategoryTRAVEL_AND_LOCAL  -0.231   0.066     -0.073      -3.520    0.000   -0.359  -0.102
    CategoryVIDEO_PLAYERS  -0.279   0.069     -0.073      -4.060    0.000   -0.413  -0.144
          CategoryWEATHER  -0.114   0.078     -0.021      -1.458    0.145   -0.268   0.039
                  Reviews   0.000   0.000      0.064       6.577    0.000    0.000   0.000
                 TypePaid   0.076   0.018      0.042       4.179    0.000    0.041   0.112
                    Price  -0.001   0.000     -0.025      -2.604    0.009   -0.001   0.000
                     Size   0.000   0.000     -0.024      -2.507    0.012    0.000   0.000
----------------------------------------------------------------------------------------
```

Screenshot 41

```
                    Selection Summary
--------------------------------------------------------------
variable     AIC       Sum Sq     RSS       R-Sq     Adj. R-Sq
--------------------------------------------------------------
Category  14603.046    65.218   2426.061   0.02618   0.02329
Reviews   14563.929    74.403   2416.875   0.02987   0.02690
Type      14553.376    77.201   2414.077   0.03099   0.02794
Price     14548.526    78.726   2412.552   0.03160   0.02846
Size      14544.219    80.129   2411.149   0.03216   0.02894
--------------------------------------------------------------
```

Screenshot 42

```
> ols_step_backward_aic(multiple2, details= TRUE)
Backward Elimination Method
---------------------------

Candidate Terms:

1 . Category
2 . Type
3 . Size
4 . Price
5 . Reviews

 Step 0: AIC = 14544.22
 Rating ~ Category + Type + Size + Price + Reviews

-----------------------------------------------------------------------
Variable      DF      AIC        Sum Sq      RSS       R-Sq     Adj. R-Sq
-----------------------------------------------------------------------
Size          1    14548.526     1.403     2412.552    0.032      0.028
Price         1    14549.023     1.514     2412.663    0.032      0.028
Type          1    14559.728     3.898     2415.047    0.031      0.027
Reviews       1    14585.535     9.655     2420.804    0.028      0.025
Category      1    14753.723    61.615     2472.764    0.007      0.007
-----------------------------------------------------------------------


Variables Removed:


No more variables to be removed.

Variables Removed:



Final Model Output
------------------

                        Model Summary
---------------------------------------------------------------
R                      0.179     RMSE                 0.472
R-Squared              0.032     Coef. Var           11.269
Adj. R-Squared         0.029     MSE                  0.223
Pred R-Squared         0.026     MAE                  0.314
---------------------------------------------------------------
 RMSE: Root Mean Square Error
 MSE: Mean Square Error
 MAE: Mean Absolute Error
```

Screenshot 43

```
                                   ANOVA
-------------------------------------------------------------------
            Sum of
            Squares       DF    Mean Square      F      Sig.
-------------------------------------------------------------------
Regression   80.129       36        2.226      9.972   0.0000
Residual   2411.149    10802        0.223
Total      2491.278    10838
-------------------------------------------------------------------


                             Parameter Estimates
-----------------------------------------------------------------------------------------
                    model    Beta   Std. Error   Std. Beta      t      Sig    lower   upper
-----------------------------------------------------------------------------------------
              (Intercept)    4.349     0.059                 74.197   0.000   4.234   4.464
  CategoryAUTO_AND_VEHICLES -0.155     0.078      -0.029     -1.996   0.046  -0.308  -0.003
            CategoryBEAUTY  -0.085     0.087      -0.012     -0.968   0.333  -0.256   0.087
 CategoryBOOKS_AND_REFERENCE -0.041    0.066      -0.012     -0.620   0.535  -0.171   0.089
          CategoryBUSINESS  -0.199     0.063      -0.084     -3.185   0.001  -0.322  -0.077
            CategoryCOMICS  -0.188     0.085      -0.029     -2.228   0.026  -0.354  -0.023
     CategoryCOMMUNICATION  -0.205     0.063      -0.079     -3.232   0.001  -0.329  -0.081
            CategoryDATING  -0.340     0.066      -0.103     -5.133   0.000  -0.470  -0.210
         CategoryEDUCATION   0.038     0.070       0.010      0.549   0.583  -0.098   0.175
     CategoryENTERTAINMENT  -0.225     0.070      -0.055     -3.199   0.001  -0.362  -0.087
            CategoryEVENTS   0.020     0.083       0.003      0.236   0.814  -0.143   0.183
            CategoryFAMILY  -0.159     0.060      -0.128     -2.676   0.007  -0.276  -0.043
           CategoryFINANCE  -0.203     0.064      -0.077     -3.193   0.001  -0.328  -0.078
    CategoryFOOD_AND_DRINK  -0.176     0.072      -0.040     -2.443   0.015  -0.317  -0.035
              CategoryGAME  -0.080     0.060      -0.051     -1.329   0.184  -0.198   0.038
 CategoryHEALTH_AND_FITNESS -0.082     0.064      -0.030     -1.277   0.202  -0.207   0.044
     CategoryHOUSE_AND_HOME -0.148     0.077      -0.028     -1.918   0.055  -0.300   0.003
  CategoryLIBRARIES_AND_DEMO -0.144    0.078      -0.026     -1.838   0.066  -0.297   0.010
         CategoryLIFESTYLE  -0.231     0.063      -0.089     -3.636   0.000  -0.355  -0.106
 CategoryMAPS_AND_NAVIGATION -0.284    0.071      -0.066     -3.993   0.000  -0.424  -0.145
           CategoryMEDICAL  -0.167     0.063      -0.070     -2.664   0.008  -0.290  -0.044
 CategoryNEWS_AND_MAGAZINES -0.205     0.065      -0.068     -3.153   0.002  -0.332  -0.078
         CategoryPARENTING  -0.065     0.085      -0.010     -0.769   0.442  -0.231   0.101
    CategoryPERSONALIZATION -0.059     0.063      -0.023     -0.930   0.353  -0.183   0.065
       CategoryPHOTOGRAPHY  -0.165     0.064      -0.059     -2.571   0.010  -0.290  -0.039
      CategoryPRODUCTIVITY  -0.143     0.063      -0.058     -2.264   0.024  -0.266  -0.019
          CategorySHOPPING  -0.095     0.066      -0.030     -1.456   0.145  -0.224   0.033
            CategorySOCIAL  -0.119     0.065      -0.040     -1.839   0.066  -0.246   0.008
            CategorySPORTS  -0.132     0.063      -0.051     -2.078   0.038  -0.256  -0.007
             CategoryTOOLS  -0.286     0.061      -0.160     -4.701   0.000  -0.405  -0.167
   CategoryTRAVEL_AND_LOCAL -0.231     0.066      -0.073     -3.520   0.000  -0.359  -0.102
     CategoryVIDEO_PLAYERS  -0.279     0.069      -0.073     -4.060   0.000  -0.413  -0.144
           CategoryWEATHER  -0.114     0.078      -0.021     -1.458   0.145  -0.268   0.039
                  TypePaid   0.076     0.018       0.042      4.179   0.000   0.041   0.112
                      Size   0.000     0.000      -0.024     -2.507   0.012   0.000   0.000
                     Price  -0.001     0.000      -0.025     -2.604   0.009  -0.001   0.000
                   Reviews   0.000     0.000       0.064      6.577   0.000   0.000   0.000
-----------------------------------------------------------------------------------------
[1] "No variables have been removed from the model."
```

Screenshot 44

- *Finally, we are performing N-Fold Cross validation for the final prediction of the rating of application.*

```
> model <- train(Rating~Category+Price+Size+Type+Reviews,data=dataset, trControl=train_control, method="lm",na.action=na.pass)
> summary(model)

Call:
lm(formula = .outcome ~ ., data = dat)

Residuals:
    Min      1Q  Median      3Q     Max
-3.2679 -0.1423  0.0568  0.2569  1.0002

Coefficients:
                             Estimate Std. Error t value Pr(>|t|)
(Intercept)                 4.349e+00  5.861e-02  74.197  < 2e-16 ***
CategoryAUTO_AND_VEHICLES  -1.554e-01  7.785e-02  -1.996 0.045960 *
CategoryBEAUTY             -8.461e-02  8.744e-02  -0.968 0.333260
CategoryBOOKS_AND_REFERENCE -4.114e-02 6.636e-02  -0.620 0.535320
CategoryBUSINESS           -1.994e-01  6.261e-02  -3.185 0.001452 **
CategoryCOMICS             -1.884e-01  8.459e-02  -2.228 0.025923 *
CategoryCOMMUNICATION      -2.051e-01  6.344e-02  -3.232 0.001231 **
CategoryDATING             -3.400e-01  6.624e-02  -5.133 2.91e-07 ***
CategoryEDUCATION           3.830e-02  6.976e-02   0.549 0.582987
CategoryENTERTAINMENT      -2.247e-01  7.024e-02  -3.199 0.001382 **
CategoryEVENTS              1.963e-02  8.320e-02   0.236 0.813529
CategoryFAMILY             -1.594e-01  5.958e-02  -2.676 0.007459 **
CategoryFINANCE            -2.032e-01  6.364e-02  -3.193 0.001414 **
CategoryFOOD_AND_DRINK     -1.760e-01  7.206e-02  -2.443 0.014591 *
CategoryGAME               -8.016e-02  6.030e-02  -1.329 0.183795
CategoryHEALTH_AND_FITNESS -8.165e-02  6.395e-02  -1.277 0.201749
CategoryHOUSE_AND_HOME     -1.482e-01  7.728e-02  -1.918 0.055177 .
CategoryLIBRARIES_AND_DEMO -1.439e-01  7.829e-02  -1.838 0.066093 .
CategoryLIFESTYLE          -2.306e-01  6.342e-02  -3.636 0.000278 ***
CategoryMAPS_AND_NAVIGATION -2.841e-01 7.116e-02  -3.993 6.57e-05 ***
CategoryMEDICAL            -1.670e-01  6.268e-02  -2.664 0.007722 **
CategoryNEWS_AND_MAGAZINES -2.049e-01  6.499e-02  -3.153 0.001621 **
CategoryPARENTING          -6.505e-02  8.458e-02  -0.769 0.441878
CategoryPERSONALIZATION    -5.888e-02  6.335e-02  -0.930 0.352648
CategoryPHOTOGRAPHY        -1.647e-01  6.404e-02  -2.571 0.010146 *
CategoryPRODUCTIVITY       -1.425e-01  6.294e-02  -2.264 0.023595 *
CategorySHOPPING           -9.540e-02  6.553e-02  -1.456 0.145496
CategorySOCIAL             -1.192e-01  6.482e-02  -1.839 0.065877 .
CategorySPORTS             -1.317e-01  6.337e-02  -2.078 0.037719 *
CategoryTOOLS              -2.861e-01  6.085e-02  -4.701 2.62e-06 ***
CategoryTRAVEL_AND_LOCAL   -2.308e-01  6.557e-02  -3.520 0.000434 ***
CategoryVIDEO_PLAYERS      -2.786e-01  6.864e-02  -4.060 4.95e-05 ***
CategoryWEATHER            -1.144e-01  7.847e-02  -1.458 0.144849
Price                      -7.664e-04  2.943e-04  -2.604 0.009221 **
Size                       -1.271e-04  5.069e-05  -2.507 0.012179 *
TypePaid                    7.634e-02  1.827e-02   4.179 2.95e-05 ***
Reviews                     1.041e-08  1.583e-09   6.577 5.03e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4725 on 10802 degrees of freedom
Multiple R-squared:  0.03216,   Adjusted R-squared:  0.02894
F-statistic: 9.972 on 36 and 10802 DF,  p-value: < 2.2e-16
```
<div align="center">Screenshot 45</div>

```
> model
Linear Regression

10839 samples
    5 predictor

No pre-processing
Resampling: Cross-Validated (10 fold)
Summary of sample sizes: 9755, 9756, 9754, 9754, 9755, 9754, ...
Resampling results:

  RMSE       Rsquared    MAE
  0.4724772  0.02748946  0.3155124

Tuning parameter 'intercept' was held constant at a value of TRUE
```
<div align="center">Screenshot 46</div>

```
> #Final N-Fold Cross validation model
> set.seed(100)
> model_Final <- train(Rating~Category+Price+Size,data=data2, trControl=train_control, method="lm",na.action=na.pass)
> summary(model_Final)

Call:
lm(formula = .outcome ~ ., data = dat)

Residuals:
    Min     1Q  Median     3Q     Max
-3.2198 -0.1070  0.0270  0.2955  0.9009

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.230e+00  1.095e-02 386.416  < 2e-16 ***
Category    -1.866e-03  5.510e-04  -3.386 0.000711 ***
Price       -6.064e-04  2.886e-04  -2.101 0.035624 *
Size        -9.915e-05  5.062e-05  -1.959 0.050168 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4791 on 10835 degrees of freedom
Multiple R-squared:  0.001814,  Adjusted R-squared:  0.001538
F-statistic: 6.564 on 3 and 10835 DF,  p-value: 0.0001983

> model_Final
Linear Regression

10839 samples
    3 predictor

No pre-processing
Resampling: Cross-Validated (10 fold)
Summary of sample sizes: 9754, 9756, 9753, 9756, 9754, 9757, ...
Resampling results:

  RMSE       Rsquared     MAE
  0.4788429  0.002691789  0.3144538

Tuning parameter 'intercept' was held constant at a value of TRUE
```

Screenshot 47