

Using Simulation to Model Customer Behavior in the Context of Customer Lifetime Value Estimation

In-Class Student Simulation Exercise

Shahid Ansari, Alfred J. Nanni

Dessislava A. Pachamanova, David P. Kopcsó

In this exercise, students will evaluate the impact of the assumptions about customer behavior on the expected number of months a customer will stay with Virgin Mobile and the forecasted lifetime value (LTV) of the customer. By running a simulation with @RISK, students will be able to estimate not only the expected values of these quantities, but also the risk faced by Virgin Mobile.

Recall that in calculating the LTV of a customer, the case made the assumption that the churn rate for customers with contracts is 2%, whereas the churn rate for customers without contracts is 6%. The two different churn rates resulted in very different estimates for the LTV. The expected number of months a customer will stay with Virgin Mobile is $1/0.02 = 50$ months for a churn rate of 2% and $1/0.06 = 16.67$ months for a churn rate of 6%.

Is the assumption of a constant churn rate acceptable? What if we change the assumptions to the following customer behaviors?

Case 1. The customer is more likely to switch to another carrier during months 2–6 (with probability 6% per month), but if he or she has stayed with Virgin Mobile for 6 months, the probability of switching to another carrier decreases to 2% for subsequent months;

Case 2. The customer is unlikely to switch to another carrier in months 2–3 (the probability of switching is only 1%), but the probability increases to 6% for the following 12 months, and to 30% after that.

Study groups 1–4: Please use the template file VMSimulation_1.xls to incorporate Case 1 in the pricing model for Virgin Mobile.

Study groups 5–9: Please use the template file VMSimulation_2.xls to incorporate Case 2 in the pricing model for Virgin Mobile.

Instructions for Filling Out the Model Templates

All Groups:

1. Open your template file. The top left part of the worksheet contains input data for computing the LTV of a customer. Cells B10 and B11 (Lifetime Value of a Customer and Actual Customer Life (months)) are outputs and should be the cells your simulation model tracks, so make sure you specify that for @RISK.

2. You only need to fill out the cells with blue borders to complete the model (see below):

(a) In Column B (cells B14:B372), input the assumptions on the churn probability for each month. These assumptions can be found in cells E3 and E4 for Case 1 and in cells E3, E4, and E5 for Case 2 (colored in yellow). Note

that the probability of switching in the first month is 0%. (Assume that the customer has committed for one month.)

(b) In Column D (cells D14:D372), you need to define a distribution for @RISK so that @RISK simulates whether a customer is “current” or has switched to another carrier during that month.

Hint: Define this as a discrete distribution with value 0 (switch) that happens with the churn probability for that month (corresponding value in that row for Column B), and 1 with the probability of staying with Virgin Mobile (corresponding value in that row in Column C).

Be careful: Once a customer has switched, he/she should stay switched, and should not generate any future cash flows for Virgin Mobile. In other words, once @RISK has generated a scenario with value 0 in Column D, all subsequent cells below that cell in Column D should contain 0's. One way to make Excel do this is to use an IF statement and the MIN function. If the MIN of all the cells *above* the current cell in which you enter the formula is equal to 1, then draw a random number (0 or 1) with @RISK, otherwise, make the value of that cell equal to 0:

=IF(MIN(<cells above>)=1, <enter @RISK function>, 0)

(c) Finally, fill out Column F (cells F14:F372). The value in those cells should be the monthly margin (\$22) discounted by the appropriate compounded interest rate from Column E if the customer is current (i.e., has not switched yet), and 0 if the customer has already switched. You may want to use an expression of the kind =IF(<customer is current>, monthly margin/compounded interest rate, 0).

3. Everything else in the model has been set up for you. Run @RISK, and be ready to report on:

(a) The *expected* (average) LTV of a customer (simulation output for Cell B10).

(b) The *expected* (average) number of months a customer stays with Virgin Mobile (simulation output for Cell B11).

(c) The *variability* in the LTV of a customer and the number of months a customer stays with Virgin Mobile.

(d) The probability that the LTV of a customer will be negative.

(e) The accuracy in estimation of the *expected* values of the lifetime value of a customer and the life of the customer.

Hint: Recall the calculation of 95% confidence interval estimate for the actual average based on the output from a simulation.