

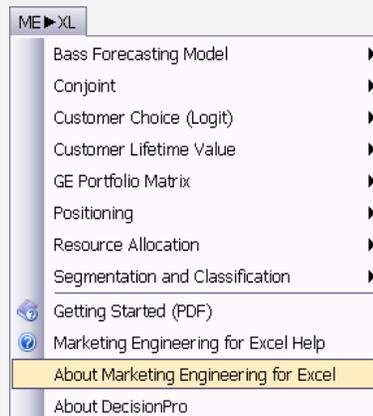
# Tutorial

## Customer Lifetime Value



*Marketing Engineering for Excel* is a *Microsoft Excel* add-in. The software runs from within *Microsoft Excel* and only with data contained in an *Excel* spreadsheet.

After installing the software, simply open *Microsoft Excel*. A new menu appears, called "ME ▶XL." This tutorial refers to the "ME ▶XL/Customer Lifetime Value" submenu.



### Overview

Customer Lifetime Value (CLV) represents a metric of a customer's value to the organization over the entire span of their relationship. Short-term sales are a factor, but so are overall customer satisfaction, the churn rate in the segment, and the costs to acquire a new customer and retain an existing customer.

The CLV approach helps firms answer such questions as:

- ✓ How much is my customer base "worth"?
- ✓ Taking into account observed churn rates, how many currently active customers will still be active in a few years?
- ✓ How much is a customer worth, depending on the segment to which he or she belongs?
- ✓ If acquiring a new customer costs \$150, after how many periods can we recoup this investment?

Customer lifetime value analysis considers your database at a segment level, using the answers you provide to the following questions:

- ✓ How many segments do you have in your database, and how many customers per segment?
- ✓ For a given period, how much is a customer worth in each segment (margins and costs)?
- ✓ What is the likelihood that a customer in segment A will switch to segment B during the next period?

## Getting Started

A CLV analysis allows you to use your own data directly or a template preformatted by the ME<sup>XL</sup> software.



The next section explains how to create an easy-to-use template to enter your own data.

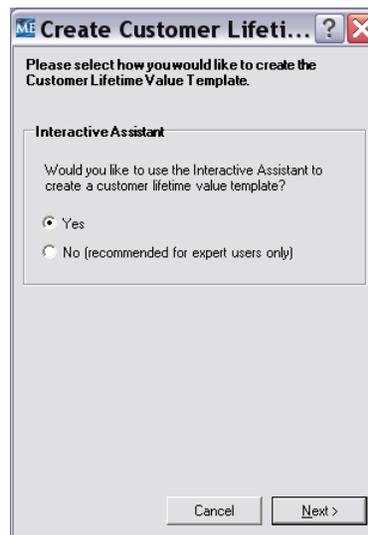
If you want to run a CLV analysis immediately, open the example file "OfficeStar Data (CLV).xls" and jump to "Step 3: Running analysis" (p. 5). By default, the example files install in "Documents/My Marketing Engineering/."

## Step 1 Creating a template

### Using the interactive assistant

In Excel, if you click on ME ▶ XL → CUSTOMER LIFETIME VALUE → CREATE TEMPLATE, a dialog box appears. This box represents the first step in creating a template to run the CLV analysis software. The first dialog box prompts you to use an interactive assistant.

Unless you are already familiar with the methodology, you should select "yes."



## Listing segments

The first step of the template generation process requires you to label and list the segments that you want taken into account. Enter the names of segments to which a customer can belong. Press ENTER or click the "Add to list" button to add it to the "List of Segments."

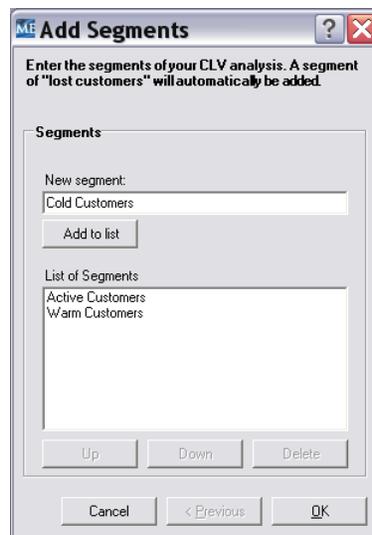


The screenshot shows a dialog box titled "Add Segments". The dialog contains the following elements:

- Title bar: "ME Add Segments" with a question mark icon and a close button (X).
- Message: "Enter the segments of your CLV analysis. A segment of 'lost customers' will automatically be added."
- Section: "Segments"
- Input field: "New segment:" with an empty text box.
- Button: "Add to list"
- List: "List of Segments" with an empty list box.
- Navigation buttons: "Up", "Down", "Delete", "Cancel", "< Previous", and "OK".

Note that a segment of "lost customers" always appears in your list. This segment has the following properties:

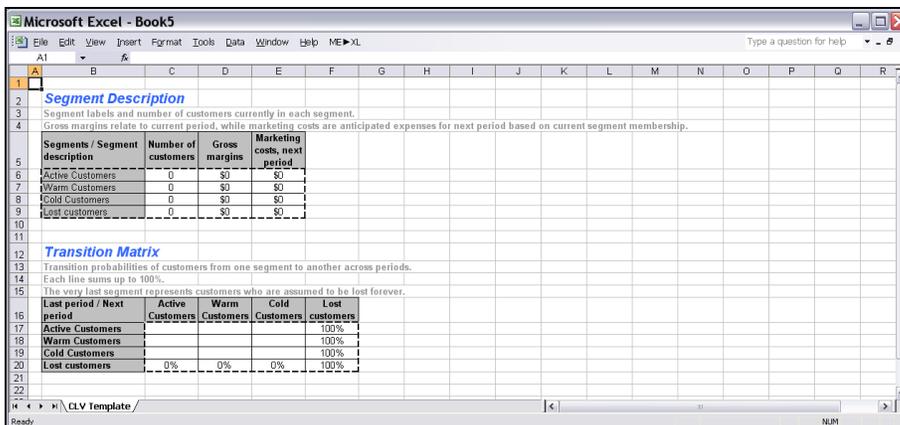
- ✓ There is no activity by these customers (margins and costs equal 0).
- ✓ It entails an absorbing relationship state. As soon as a customer reaches this segment, he or she stays there forever. In other words, there is 100% chance the customer stays in that segment in the next period, and all other transition probabilities equal 0%.



The screenshot shows the same "Add Segments" dialog box, but now with data entered:

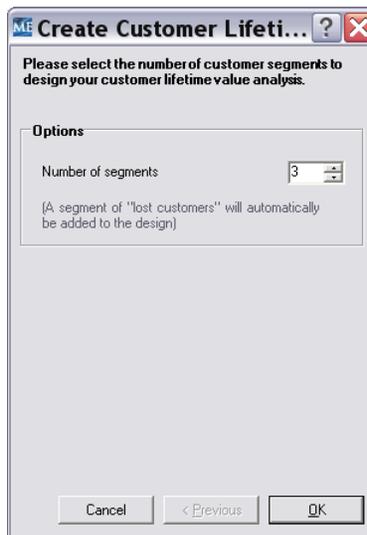
- Title bar: "ME Add Segments" with a question mark icon and a close button (X).
- Message: "Enter the segments of your CLV analysis. A segment of 'lost customers' will automatically be added."
- Section: "Segments"
- Input field: "New segment:" with the text "Cold Customers" entered.
- Button: "Add to list"
- List: "List of Segments" with the text "Active Customers" and "Warm Customers" listed.
- Navigation buttons: "Up", "Down", "Delete", "Cancel", "< Previous", and "OK".

After entering all your segments (at least one), click the OK button to proceed to the next step of the template creation process. Clicking on the OK button generates a template.



### Not using the interactive assistant

You may skip this intermediary step and create a blank template. When you are prompted to use the interactive assistant, just click "no." The following dialog box appears:



When you click OK, you generate a new blank spreadsheet. You must enter the segment labels manually in the spreadsheet.

**Segment Description**

Segment labels and number of customers currently in each segment.  
 Gross margins relate to current period, while marketing costs are anticipated expenses for next period based on current segment membership.

Segments / Segment description	Number of customers	Gross margins	Marketing costs, next period
Enter segment label 1 here	0	\$0	\$0
Enter segment label 2 here	0	\$0	\$0
Enter segment label 3 here	0	\$0	\$0
Lost customers	0	\$0	\$0

**Transition Matrix**

Transition probabilities of customers from one segment to another across periods.  
 Each line sums up to 100%.  
 The very last segment represents customers who are assumed to be lost forever.

Last period / Next period	Enter segment label 1 here	Enter segment label 2 here	Enter segment label 3 here	Lost customers
Enter segment label 1 here				100%
Enter segment label 2 here				100%
Enter segment label 3 here				100%
Lost customers	0%	0%	0%	100%

In this example, if you update the names of the segments in cells B6, B7, and B8, the names of the segments automatically update in the other cells of the spreadsheet.

## Step 2 Entering your data



In this tutorial, we use the example file "OfficeStar Data (CLV).xls," which in the default conditions appear in "Documents/My Marketing Engineering/."

To view a proper data format, open that spreadsheet in Excel. A snapshot is reproduced below.

**Segment Description**

Segment labels and number of customers currently in each segment.  
 Gross margins relate to current period, while marketing costs are anticipated expenses for next period based on current segment membership.

Segments / Segment description	Number of customers	Gross margins	Marketing costs, next period
Active Customers	12000	\$90	\$25
Warm Customers	4000	\$0	\$15
Cold Customers	3000	\$0	\$10
Lost customers	6000	\$0	\$0

**Transition Matrix**

Transition probabilities of customers from one segment to another across periods.  
 Each line sums up to 100%.  
 The very last segment represents customers who are assumed to be lost forever.

Last period / Next period	Active Customers	Warm Customers	Cold Customers	Lost customers
Active Customers	75%	25%	0%	0%
Warm Customers	33%		70%	0%
Cold Customers	8%			92%
Lost customers	0%	0%	0%	100%

A typical CLV analysis spreadsheet contains:

- **Number of customers** per segment. As of today, how many customers does the company have in each segment?
- **Gross margins**, or the average margins that the company expects from a customer over each period (e.g., year, quarter), on the basis of the segment to which this customer belongs during that period. In the

OfficeStar example, a customer who belongs to the "Warm Customer" segment should generate \$27 of gross margins on average during the next period (30% of Warm Customers will transition to Active Customers and account for \$90 gross margin per customer:  $30\% * \$90 = \$27$  average gross margin).

- **Marketing costs**, or how much money the company plans to spend per customer during the next period, according to the segment to which this customer belongs at the beginning of the period. Typically, active customers are followed more closely, receive more attention (e.g., direct marketing solicitations, sales representatives visits), and cost more to the firm.
- **Transition matrix**, which summarizes the likelihood a customer will switch segments during each period. This matrix should be read horizontally, and each line sums to 100% (because all customers appear in some segment). In the OfficeStar example, an active customer has a 75% likelihood of remaining in the same segment and a 25% chance of switching to the warm customer segment.

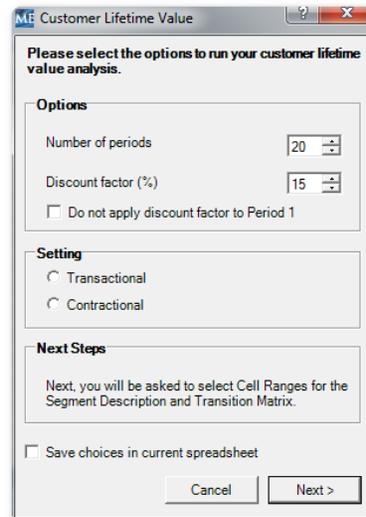


A customer's behavior during the previous period determines into which segment that customer is classified, and his or her segment membership then determines the marketing dollars the company should allocate to that customer in the next period.

In the OfficeStar example, a warm customer costs \$15 in next period, but the margins this customer will generate remain unknown. A warm customer has a 30% chance of becoming an active customer (and thus generating \$90 of gross margins, for \$75 net profit) but a 70% chance of becoming a cold customer (and thus generating no revenues whatsoever, for a loss of \$15).

### Step 3 Running analyses

After entering your data in the Excel spreadsheet using the appropriate format, click on ME ▶ XL → CUSTOMER LIFETIME VALUE → RUN ANALYSIS. The dialog box that appears indicates the next steps required to perform a CLV analysis of your data.



- **Number of periods:** Specify the number of periods for which you want a detailed CLV analysis. Note that this choice does NOT affect the CLV computations, because the value of a customer always gets estimated over an infinite time horizon (though as time passes and discount rates apply, future revenues have less relative impact). The number of periods affects only the level of output. A "period" within the software is not a specific length of time; it can be any length of time that you choose (e.g., month, quarter, year, etc.).
- **Discount factor:** Indicate the discount rate to apply for the value of a dollar spent or received in the future compared with currently. A discount rate of 15% means that \$100 profit in the next period is only "worth" \$86.9 in today's dollars, after applying the following formula:

$$\text{Discounted Value} = \text{Value} / (1 + \text{Discount Rate})$$

A greater discount factor reduces the impact of future revenues on CLV computations and thus focuses on short-term profits. You should increase the discount rate for turbulent or rapidly evolving markets, in which conditions change rapidly and future revenues therefore are highly uncertain.



The *discount factor* gets applied after each period, regardless of how you define a period.

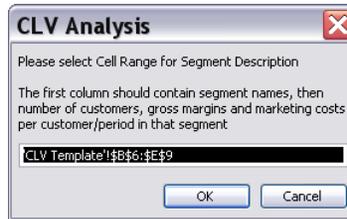
If you define a period as a quarter, a discount factor of 15% translates into an effective yearly discount rate of almost 48% (15% discount rate applied four times per year). Remember to take this multiplicative effect into account when selecting an appropriate discount factor.

- **Setting:** Select either Transactional or Contractual depending on the nature of the product or service you are modelling.
  - Contractual models imply the existence of a contract between the transacting parties (e.g., a mobile phone contract between the provider and consumer). Contractual relationships imply continuous transactions and a known end to the contract.
  - Transactional models imply discrete transactions with no implied end to the relationship (although customers who lapsed for several periods might be considered "lost" once and for all).

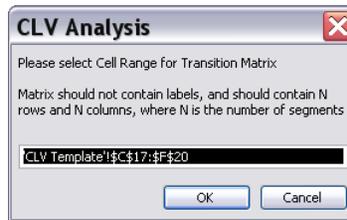
For use with our CLV model, the impact of this setting will affect the first period of the analysis. A Contractual setting implies no loss/gain of customer in the first period (since the customer is under contract) while the Transactional setting will reflect loss/gain in the first period.

After selecting these options, you must select the cells containing the data.

First, the software asks for ranges of the current segment sizes and profits and costs for each segment, including a row dedicated to permanently lost customers. If you use a template generated by Marketing Engineering for Excel, it has already pre-selected the cell ranges.



Second, the software asks for a square range that shows the likelihood that a customer in each segment (row) will switch to each segment (column) in the following period.



The newly generated spreadsheet contains the results of your CLV analysis.

#### **How to obtain results from the "standard" CLV formula**

The textbook formula to compute CLV is often given as:

$$\text{CLV} = (\text{Revenues} - \text{Costs}) / (1 - \text{retention} + \text{discount})$$

As an illustration, let's take the example introduced by Ofek (2002), and discussed on p.53 of *Principles of Marketing Engineering 2<sup>nd</sup> Ed.*:

- The gross margin per customer and per year is \$14 (\$20 of revenues *minus* \$6 of costs).
- The retention rate is 75% (i.e., the churn rate is 25%).
- The discount rate is 10%.

This gives the value:

$$\text{CLV} = (\$20 - \$6) / (1 - 0.75 + 0.10) = \$40$$

To obtain the same results within Marketing Engineering for Excel, enter the following data:

Segment Description			
Number of customers currently in each segment, gross margins generated per period			
Segments / Segment description	Number of customers	Gross margins	Marketing costs, next period
Active customers	1	\$14	\$0
Lost customers	0	\$0	\$0

Transition Matrix		
Transition probabilities of customers from one segment to another across periods.		
Each line sums up to 100%.		
The very last segment represents customers who are assumed to be lost forever.		
Last period / Next period	Active customers	Lost customers
Active customers	75%	25%
Lost customers	0%	100%

And run the analyses with the **contractual setting** and **apply discount rate in period 1** options. The software will give the expected answer: \$40.

The textbook CLV formula is therefore a simple case of the more general CLV framework introduced in ME ▶ XL, where (a) there is only one segment of customer, (b) if a customer does not buy for one period, it is assumed it will never buy again, and (c) a customer cannot become inactive during the first period (an assumption often used in a contractual setting). All these options can be relaxed in the more general framework.

## Step 4 Interpreting the results

### Customer lifetime value

The last column of the CLV table outputs the expected CLV of a customer who currently belongs to a given segment, determined by summing the stream of all future gross margins, minus all future marketing costs, and taking into account both the discount factor and the likelihood of customers switching from one segment to another.

Customer Lifetime Value					Transactional
Individual's customer lifetime value (discount rate 15%), per segment.					
Segments / Segment description	Number of customers	Gross margins	Marketing costs, next period	Customer lifetime value	
Active Customers	12000	\$90	\$25	\$138	
Warm Customers	4000	\$0	\$15	\$51	
Cold Customers	3000	\$0	\$10	\$7	
Lost customers	6000	\$0	\$0	\$0	

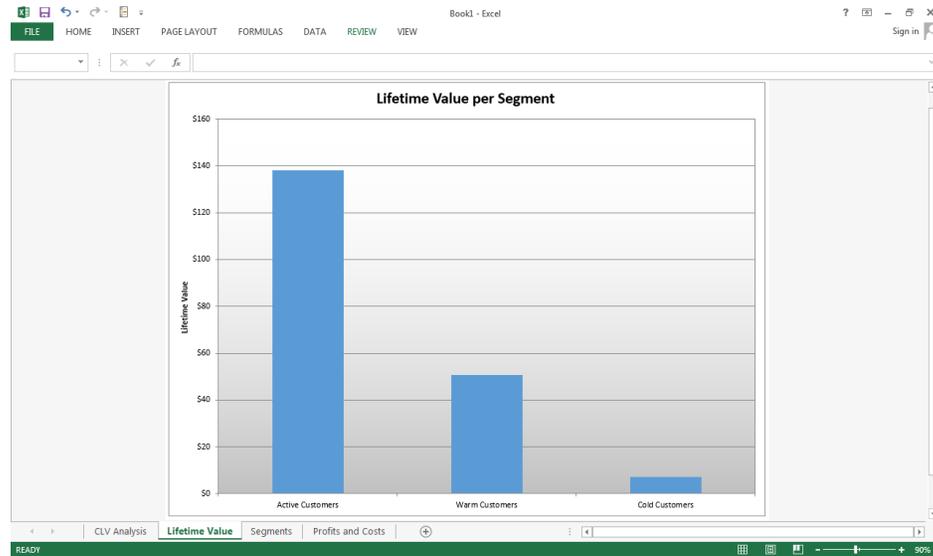
Number Of Customers Per Segment													
Simulations of number of customers per segment, over 20 periods.													
Segments / Periods	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	N+10	N+11	N+12	N+13
Active Customers	10440	8954	7667	6568	5626	4819	4128	3537	3030	2595	2223	1904	1631
Warm Customers	3000	2610	2239	1917	1642	1407	1205	1032	884	757	649	556	476
Cold Customers	2800	2100	1827	1567	1342	1149	985	843	722	619	530	454	389
Lost customers	8760	11336	13268	14949	16390	17625	18682	19588	20364	21029	21598	22086	22503

Customer Base's Lifetime Value													
Customer base's lifetime value (discount rate 15%) and discounted net margins, over 20 periods.													
Margins and costs / Period	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	N+10	N+11	N+12	N+13
Gross margins	\$939,600	\$805,860	\$689,985	\$591,083	\$506,343	\$433,748	\$371,562	\$318,291	\$272,658	\$233,567	\$200,081	\$171,395	\$146,823
Marketing costs	\$390,000	\$334,000	\$284,000	\$243,510	\$208,609	\$178,696	\$153,076	\$131,130	\$112,330	\$96,225	\$82,430	\$70,612	\$60,488
Net margins	\$549,600	\$471,860	\$405,985	\$347,573	\$297,734	\$255,053	\$218,486	\$187,161	\$160,328	\$137,342	\$117,651	\$100,784	\$86,334
Discount factor (15%)	0.87	0.76	0.66	0.57	0.50	0.43	0.38	0.33	0.28	0.25	0.21	0.19	0.16
Discounted net margins	\$477,913	\$356,794	\$266,942	\$198,726	\$148,027	\$110,266	\$82,137	\$61,183	\$45,575	\$33,949	\$25,288	\$18,837	\$14,032
Discounted net margins (c)	\$477,913	\$834,707	\$1,101,649	\$1,300,375	\$1,448,401	\$1,558,667	\$1,640,804	\$1,701,988	\$1,747,563	\$1,781,512	\$1,806,800	\$1,825,637	\$1,839,669

The above example was run using the OfficeStar CLV data set, using Transactional analysis, first period discount and a discount factor of 15%.

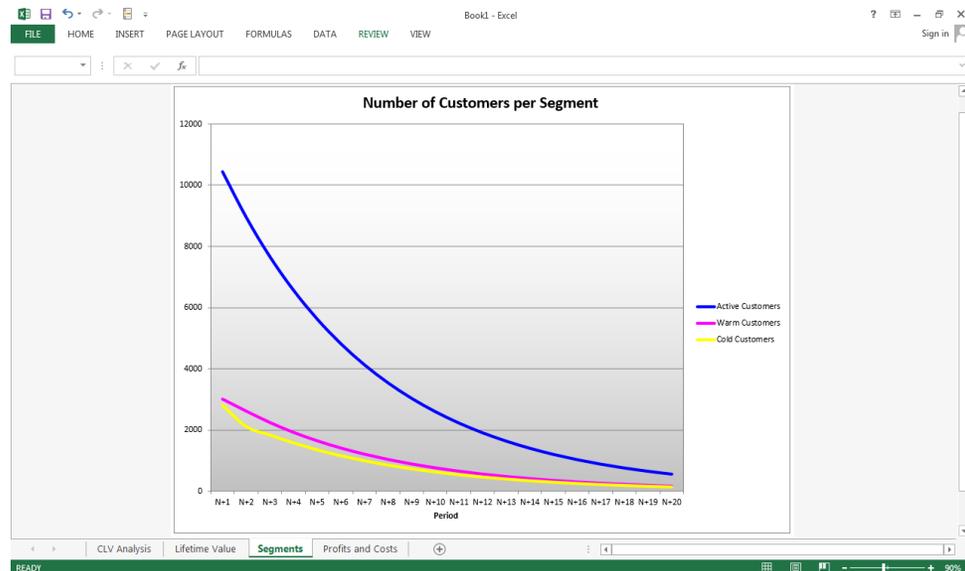
These figures also appear in the "Lifetime Value" chart, shown below.



A customer with a *negative* CLV actually means a loss of money for your firm.

### Number of customers per segment

The next table (and chart) shows how many customers will be in each segment at each period of time in the future. The time horizon displayed on the chart matches the number of periods you specified in the "Run Analysis" options.

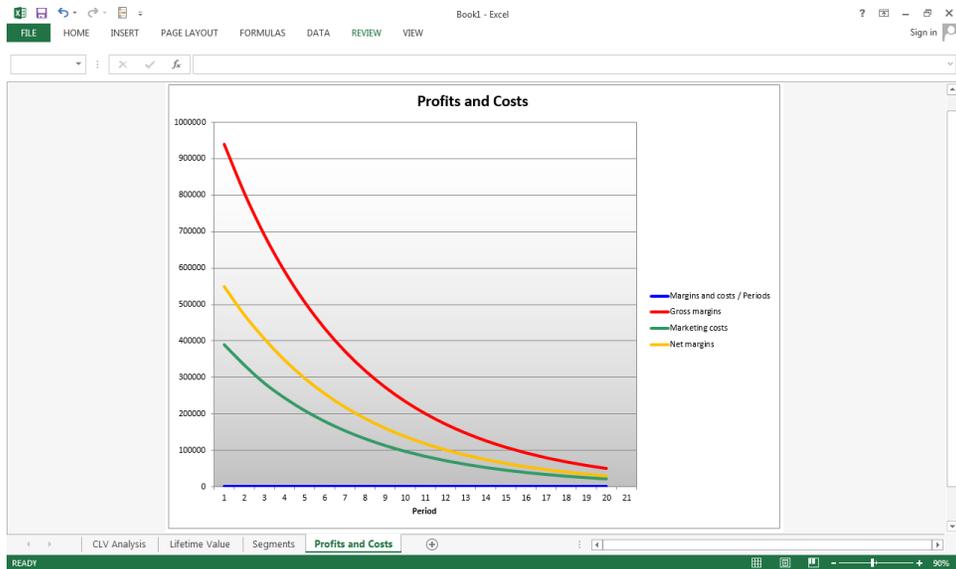


Note that the "Lost Customers" segment is not displayed. In most applications, all customers eventually become lost customers, and over sufficient time, all other segments become empty.

## Customer base's lifetime value

The third table in the "CLV Analysis" sheet, labeled the Customer Base's Lifetime Value, summarizes the future stream of revenues and marketing costs over a specified number of future periods (whether cumulative or not) at the global level. Some key elements of this table plot in the third (and last) chart of the spreadsheet.

In particular, the **Discounted Net Margins (cumulated)** provide an answer to the question: "Over the next x periods, how much is my customer base worth?"



## Retention rates

The final tables depict the likelihood that a customer will belong to any segment in any period of time in the future, depending on the segment to which he or she currently belongs. There are as many tables as there are segments in the analysis.

### Retention Rate (Active Customers)

Retention rate of a customer currently in the "Active Customers" segment.

Segments / Periods	N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	N+10	N+11	N+12	N+13
Active Customers	1.00	0.75	0.64	0.55	0.47	0.40	0.34	0.30	0.25	0.22	0.19	0.16	0.14	0.12
Warm Customers	n/a	0.25	0.19	0.16	0.14	0.12	0.10	0.09	0.07	0.06	0.05	0.05	0.04	0.03
Cold Customers	n/a	0.00	0.18	0.13	0.11	0.10	0.08	0.07	0.06	0.05	0.04	0.04	0.03	0.03
Lost customers	n/a	0.00	0.00	0.16	0.28	0.38	0.47	0.55	0.61	0.67	0.72	0.76	0.79	0.82

### Retention Rate (Warm Customers)

Retention rate of a customer currently in the "Warm Customers" segment.

Segments / Periods	N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	N+10	N+11	N+12	N+13
Active Customers	n/a	0.30	0.28	0.23	0.20	0.17	0.15	0.13	0.11	0.09	0.08	0.07	0.06	0.05
Warm Customers	1.00	0.00	0.08	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01
Cold Customers	n/a	0.70	0.00	0.05	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01
Lost customers	n/a	0.00	0.64	0.64	0.69	0.74	0.78	0.81	0.83	0.86	0.88	0.90	0.91	0.92

### Retention Rate (Cold Customers)

Retention rate of a customer currently in the "Cold Customers" segment.

Segments / Periods	N	N+1	N+2	N+3	N+4	N+5	N+6	N+7	N+8	N+9	N+10	N+11	N+12	N+13
Active Customers	n/a	0.08	0.06	0.05	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01
Warm Customers	n/a	0.00	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Cold Customers	1.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Lost customers	n/a	0.92	0.92	0.92	0.93	0.94	0.95	0.96	0.96	0.97	0.97	0.98	0.98	0.98

In most applications, all customers eventually join the "Lost Customers" segment. The probability of belonging to that segment thus slowly reaches 1 (100%), and the probabilities of belonging to any other segment trend toward 0 over time.