

# CHAPTER 5

## Introduction to Customer-Based Marketing Metrics

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### 5.1 OVERVIEW

Customer value management rests on the idea of allocating resources differently to different customers. The basis of this differential resource allocation is the economic value of the customer to the firm. Thus, before one can start to manage customers, one must have a thorough understanding of how to compute the value contribution each customer makes to a firm. Various economic concepts and procedures have been developed that help us do this. Some are based on simple notions, whereas some require the application of mathematical techniques. But as a precursor to understanding and applying these concepts, it is necessary to define measures or metrics of marketing activities and their outcomes. This chapter reviews traditional marketing metrics and introduces various primary customer-based metrics.

It is important at this stage to note the difference between traditional marketing metrics and customer-based metrics. Traditional marketing metrics have been in use by marketing professionals for years and are helpful in measuring performance of brands, products, and firms in a given geographical region. *Market share* and *sales growth* are popular traditional marketing metrics normally computed for the geographical area a particular market covers. These metrics were developed when individual customer data were hard or impossible to obtain and therefore do

not provide customer-level insight into the market. Historically, managerial rewards and incentives have been based on how well a manager is able to deliver on these metrics. However, over the years, the availability of customer-level data has resulted in the development of a new set of metrics that reflect the need to evaluate managerial performance based on the value each individual buyer brings to the customer base of the firm. In order to arrive at some measure of customer value, various activities and their costs and returns need to be recorded and measured. *Acquisition rate* and *acquisition cost* are two primary metrics that measure the customer-level success of marketing efforts aimed at acquiring new customers. Metrics have also been developed to track customer activities after they have been acquired until they cease to be customers. *Retention rate*, *survival rate*, *probability of a customer being active*— $P(\text{Active})$ —and *customer lifetime duration* are some such metrics. In industries with high churn such as Internet service providers (ISPs) and telecom services, it is also possible to win back some customers who have left. *Win-back rate* is thus an important metric of marketing performance in such industries. Thus, various marketing metrics which will be discussed in the course of this chapter and the next chapter can be classified as follows:

1. Traditional marketing metrics
  - a. Market share
  - b. Sales growth
2. Primary customer-based metrics
  - a. Acquisition rate
  - b. Acquisition cost
  - c. Retention rate
  - d. Survival rate
  - e.  $P(\text{Active})$
  - f. Lifetime duration
  - g. Win-back rate
3. Popular customer-based value metrics
  - a. Share of category requirement
  - b. Size of wallet
  - c. Share of wallet
  - d. Expected share of wallet
4. Strategic customer-based value metrics
  - a. Past customer value
  - b. RFM value
  - c. Customer lifetime value
  - d. Customer equity

The key for the various notations used in the formulas is given in appendix 1.

## 5.2 TRADITIONAL MARKETING METRICS

### 5.2.1 MARKET SHARE (MS)

*Market share* is one of the most common metrics for measuring marketing performance. It is defined as the share of a firm's sales relative to the sales of all firms—across all customers

in the given market. MS is an aggregate measure across customers, and it is measured in percentage. It can be calculated either on a monetary or a volumetric basis.

$$\text{MS (\% of a firm } (j) \text{ in a category)} = 100 \times \left[ \frac{S_j}{\sum_{j=1}^J S_j} \right] \quad (1)$$

where:

$j$  = firm

$S$  = sales

$\sum S_j$  = sum of sales across all firms in the market

Where does the information come from?

- Numerator: Sales of the focal firm are readily available from internal records.
- Denominator: Category sales are available from market research reports or from competitive intelligence.

## Evaluation

Market share is one of the most common measures of marketing performance because it conveys an important piece of information and is readily computed. It is a typical measure of a product-focused marketing approach. However, it doesn't give any information about how the sales are distributed by customers—it only gives an aggregate notion of category performance. For example, a given market share can be caused by selling large amounts to a small percentage of the customer base or by making small sales to a large proportion of the market.

### 5.2.2 SALES GROWTH

Sales growth of a brand, product, or a firm is a simple measure that compares the increase or decrease in sales volume or sales value in a given period to sales volume or value in the previous period. Hence, it is measured in percentage. It indicates the degree of improvement in the sales performance between two or more time periods and acts as a flag for the management. A negative sales growth or sales growth lower than the rest of the market is normally a cause for concern.

$$\text{Sales growth in period } t \text{ (\%)} = 100 \times \left[ \frac{\Delta S_{jt}}{S_{jt-1}} \right] \quad (2)$$

where:

$J$  = firm

$S_{jt}$  = change in sales in period  $t$  from period  $t - 1$ ,

$S_{jt-1}$  = sales in period  $t - 1$

Where does the information come from?

- Both the numerator and denominator are available from internal records.

## Evaluation

Sales growth is a quick indicator of the current health of a firm. If compared with the sales growth of the other players in the market, it also provides a relative measure of performance. However, it does not tell us which customers grew and which ones did not. This information is necessary if we are to take customer-level marketing initiatives.

## 5.3 PRIMARY CUSTOMER-BASED METRICS

### 5.3.1 CUSTOMER ACQUISITION MEASUREMENT

Customer acquisition measures have been receiving more attention recently. Managers have become more sensitive toward balancing customer acquisition and customer retention activities. In order to evaluate customer acquisition activities, we use two simple concepts—acquisition rate and acquisition cost.

#### Acquisition Rate

When firms attempt to acquire customers, they are typically targeting a specific group of prospects. For example, a European credit card issuer might target the student market in Italy. In order to describe the success of the acquisition campaign, a key performance indicator is the acquisition rate—the proportion of prospects converted to customers. It is calculated by dividing the fraction of prospects acquired by the total number of prospects targeted. It is measured as a percentage.

$$\text{Acquisition rate (\%)} = 100 \times \frac{\text{Number of prospects acquired}}{\text{Number of prospects targeted}} \quad (3)$$

For example, the target market of the credit card issuer might have been two million students in Italy. Acquisition was measured in terms of new credit cards issued. The bank issued a total of 60,000 new credit cards. Thus, the acquisition rate was  $100 \times (60,000/2,000,000) = 3$  percent.

The acquisition rate denotes an *average probability* of acquiring a customer from a population. Thus, the acquisition rate is always calculated for a *group* of customers (e.g., a segment), not for an individual customer. The equivalent measure for an individual is the acquisition probability. An acquisition rate for an individual does not exist.

**Defining What Acquisition Is** Firms have different definitions for the term *acquisition*. In the credit card example, an acquisition was recorded when a new credit card was issued to the prospect. However, it is possible that the prospect signed up for the card only because she was interested in the promotional incentive and that she will never use the card. As a solution, the bank could define two different levels of acquisition—for issuing the credit card and issuing a statement (which depends on credit card activity). For example, although 60,000 credit cards have been issued to new customers, only 55,000 of them have received a statement, indicating activity on the card account. Thus, the level 1 acquisition rate is 3 percent and the level 2 acquisition rate is 2.75 percent.

In noncontractual contexts, acquisition is typically defined as the first purchase or purchasing in the first predefined period. For example, an outdoor direct-mail merchant received 110 first-time orders from a campaign based on a new mailing list of 5,000 prospects. Thus, the firm's acquisition rate is 2.2 percent.

It is important to note that acquisition rates are typically computed on a campaign-by-campaign basis. Since acquisition rates can vary tremendously within the same firm, an average (firm-wide) acquisition rate is mostly of limited value.

Where does the information come from?

- Numerator: Number of prospects acquired is determined from internal records.
- Denominator: Number of prospects targeted is gleaned from database and/or market research data.

**Evaluation** Acquisition rate is a very important metric. However, it cannot be looked at in isolation.

### Acquisition Cost

The second key metric in customer acquisition is the acquisition cost. The acquisition rate measures responsiveness to a campaign, but it doesn't say anything about the cost efficiency of a campaign. Acquisition cost is defined as the acquisition campaign spending divided by the number of acquired prospects. Acquisition cost is measured in monetary terms.

$$\text{Acquisition cost (\$)} = \frac{\text{Acquisition spending (\$)}}{\text{Number of prospects acquired}} \quad (4)$$

For example, the cost of the acquisition campaign of the Italian credit card issuer was \$3 million. Thus, the average cost of acquiring a single new customer for this campaign was  $\$3,000,000/60,000 = \$50$ . Depending on the exact definition of what constitutes acquisition, the cost can be calculated for different acquisition levels.

**Delineating Acquisition Spending** It is not difficult to identify acquisition spending in an organization that (1) acquires prospects in distinct campaigns and (2) is able to pinpoint its acquisition efforts quite precisely to the prospect group. In this situation, acquisition cost can be calculated with the highest accuracy. Any company targeting prospects through direct mail would fall in this category—it knows the precise target group and the acquisition spending directed toward that group. As soon as firms rely on broadcasted communication (e.g., advertising through television or print media), measurement of acquisition cost becomes less precise. For example, prospects can be persuaded by advertising that was originally not targeted at them but toward existing customers. Clearly, acquisition cost will seem lower if those customers enter the acquisition cost calculation—making the numbers look more attractive than they really are. Also, firms might not necessarily differentiate between acquisition advertising and retention advertising. Calculating the precise acquisition cost in such a case can become quite difficult.

Where does the information come from?

- Numerator: Acquisition spending comes from internal records.
- Denominator: Number of prospects acquired comes from internal records.

**Evaluation** Acquisition cost is a very important metric that firms should strive to continuously monitor.

### 5.3.2 CUSTOMER ACTIVITY MEASUREMENT

Once a prospect has been converted into a customer, the main phase of the customer-firm relationship begins. The concept of measuring the activity status of a customer-firm relationship deals with a very fundamental issue—whether a customer is a customer! On first sight, this might appear to be obvious. If a customer buys, then the customer is, in fact, a customer—otherwise, she is not. However, digging a little bit deeper, it seems we are uncovering a quite complicated matter. It is not at all clear what constitutes a living relationship. What's more, the meaning of an active relationship differs across industries. Clearly, one has to look at more than just purchasing acts of a customer. Customers interact with the firm in multiple ways (prepurchase inquiry, post-purchase service, complaints, and so on), all of which contribute to the entirety of the customer-firm relationship. Even

in a simple case such as grocery shopping where the purchase per se is of highest importance to both parties involved, a multitude of other nonpurchase interactions adds or detracts from the relationship quality (e.g., the interaction with service employees, the communication of the store toward the customer, and the shopping experience).

Thus, it becomes clear that the customer–firm interaction comprises many more elements that may contribute to the fabric of the relationship. In most cases, however, the sequence of purchase is used to define whether a relationship exists. However, even if one uses this simplification, there still is the issue of customer dormancy. Dormancy occurs when an ongoing relationship is disrupted temporarily during the period we do not observe any purchase activity. To state an example, this might occur naturally when someone loses her job and therefore must scale down consumption. Once the person finds a new position, she is likely to return to the old consumption pattern. Consequently, the person is not starting a new relationship but is continuing an existing relationship. (We admit this discussion becomes complex when the dormancy has been very long.)

The challenge from a managerial point of view is to establish whether a seemingly dormant relationship has ended or the customer will return. In practice, this is a very tough call to make. Dormancy will or will not be considered, depending on the specific measure used to estimate customer activity.

### Objective of Customer Activity Measurement

The reason we want to shed light on customer activity measurement is twofold. First, knowing the status of a customer's (a segment's) activity is important for managing marketing interventions. A customer-oriented organization tries to align resource allocation with actual customer behavior. Instead of mass advertising or mass marketing, managerial action can gain tremendous efficiency by adjusting its interventions to the actual customer needs or activity status. The second reason for measuring customer activity is because it is a key input in customer valuation models such as net-present value (NPV) models. The marketing function has come under increasing pressure to demonstrate how it adds to shareholder value. This demonstration typically involves the estimation of the evolving customer value over time. Thus, measuring customer activity is a critical intermediary step in this valuation process.

This section covers these types of customer activity:

- Average inter-purchase time (AIT)
- Retention rate and defection rate
- Survival rate
- Lifetime duration
- $P(\text{Active})$

Each metric has a purpose with its own strengths and weaknesses. Thus, the task of the manager will be to find the most suitable metric for a given situation.

### Average Inter-Purchase Time (AIT)

AIT is the average time between purchases. It is measured in terms of time periods (days, weeks, months, etc). It is computed by taking the inverse of the number of purchase incidences per time period.

$$\text{AIT of a customer} = \frac{1}{\text{Number of purchase incidences from the first purchase until the current time period}} \quad (5)$$

Example: If a BINGO supermarket customer buys, on average, six times at BINGO during a month, then the AIT for that customer will be  $1/6 = 0.1667$  months, or approximately 5 days ( $0.1667 \times 30$ ).

Where does the information come from?

- Denominator: Sales records are used, assuming individual customer records are maintained and individual customers are identified.

**Evaluation** AIT is an easy-to-calculate indicator which can be an important statistic of the customer's activity status, especially for those industries where customers buy on a frequent basis. As a simple rule, firm intervention might be warranted any time customers fall considerably below their AIT.

### Retention and Defection

Retention and defection are like two sides of the same coin. One can be inferred from the other, and, depending on the context, it is better to use one or the other metric. Similar to the discussion for acquisition rate, retention rate is always defined for a group of customers—that is, a segment. *Retention rate* is defined as the average likelihood that a customer purchases from the focal firm in a period ( $t$ ), given that this customer has purchased in the last period ( $t - 1$ ). The defection rate is defined as the average likelihood that a customer defects from the focal firm in a period ( $t$ ), given that the customer was purchasing up to period ( $t - 1$ ). Retention rate and defection rate are measured in percentage.

$$\text{Retention rate (\%)} = \left( \frac{\text{Number of customers in cohort buying in } (t)}{\text{Number of customers in cohort buying in } (t-1)} \right) \times 100 \quad (6)$$

This calculation is easy to perform. The resulting retention rate refers to the average retention rate of a cohort or segment of customers.

Average retention rate, lifetime duration, and average defection rate can be shown to be interrelated using the following simple formulas.

$$\text{Retention rate (\%)} = 1 - \left( \frac{1}{\text{Avg. lifetime duration}} \right) \quad (7)$$

or

$$\text{Avg. retention rate (\%)} = 1 - \text{Avg. defection rate} \quad (8)$$

Although we use the case of an average retention rate, one has to be aware that retention rates are typically *not* equal across different periods. For example, if one deals with a single cohort, proportionally fewer customers leave over time, thus making the retention rate decrease over time. One has to keep this in mind when extrapolating retention rates for one period to an entire time horizon.

Calculating the customer retention rate using equation (7) assumes knowledge of a customer's lifetime duration.<sup>1</sup> How to assess lifetime duration will be discussed later. Nevertheless, one can regroup equation (7) to calculate the average lifetime duration from the known average retention rate.

$$\text{Avg. lifetime duration} = \frac{1}{(1 - \text{Avg. retention rate})} \quad (9)$$

Example: If the average customer lifetime duration of a group of customers is four years, then the average retention rate is  $1 - (1/4) = 0.75$ , or 75 percent a year. This means

that on average, 75 percent of the customers remain customers in the next period. If we look at the effect for a cohort of customers over time (see the following table) we find that from 100 customers who start in year 1, about 32 are left at the end of year 4.

Customers starting at the beginning of year 1:	100	
Customers remaining at the end of year 1:	75	$(0.75 \times 100)$
Customers remaining at the end of year 2:	56.25	$(0.75 \times 75)$
Customers remaining at the end of year 3:	42.18	$(0.75 \times 56.25)$
Customers remaining at the end of year 4:	31.64	$(0.75 \times 42.18)$

Assuming constant retention rates, the number of retained customers in any arbitrary period ( $t + n$ ) can simply be calculated with equation (10):

$$\begin{aligned} &\text{Number of retained customers} \\ &= \text{Number of acquired customers in cohort} \times \text{Retention rate}^{(t+n)} \end{aligned} \quad (10)$$

For the previous example, the number of retained customers at the end of year 4 is  $100 \times 0.75^4 = 31.64$ . If we plot the entire series of customers who defect each period, we see the variation (or heterogeneity) around the average lifetime duration of four years (see Figure 5-1).

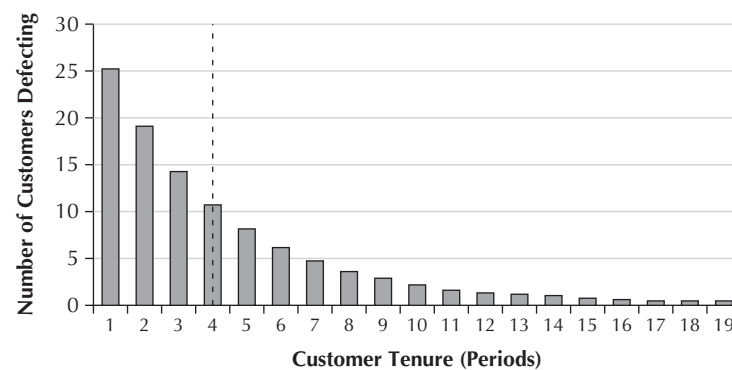
Given a retention rate of 75 percent, many customers leave in the early years. However, a small number of customers continue to stay for a long duration. This pattern results in an average lifetime duration of four years.

Assuming a constant retention rate, customer lifetime durations and retention rates are linked; see equation (7). Figure 5-2 illustrates this link. As the retention rate increases, customer lifetime duration increases disproportionately. This pattern hints at the potential attractiveness of long-term customer relationships. One has to keep in mind, however, increasing the marginal retention rate is likely to be increasingly expensive.

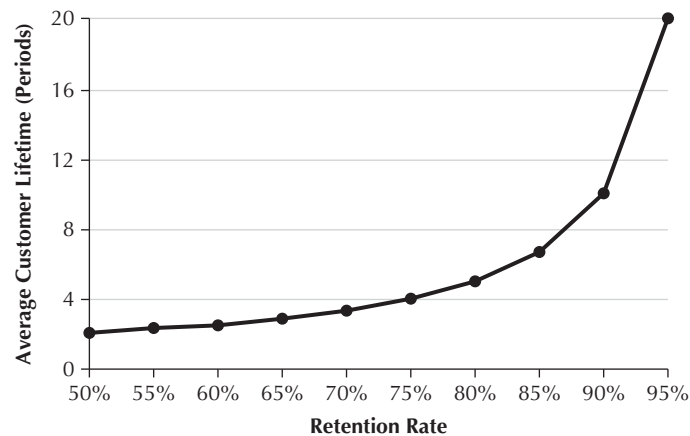
**Cautionary Note** A key assumption of the retention rate concept is that once customers leave the relationship, they are gone forever. The concept of retention rate does not allow for temporary dormancies. Managers have to make a judgment whether the dormancy phenomenon plays a major or a minor role in their business. Using the retention rate is fine if it plays a minor role. If dormancy plays a major role, other concepts have to be used to assess customer activity. These concepts will be dealt with in later sections (see lifetime duration, transition matrix).

**Is Retention only about Buying?** Typically, retention refers to the fact that a customer continues to purchase goods or services from the company. This is always the case.

**FIGURE 5-1 VARIATION IN DEFECTION RATE WITH RESPECT TO CUSTOMER TENURE**





**FIGURE 5-2 CHANGE IN RETENTION RATE WITH CUSTOMER LIFETIME DURATION**

Take, for example, Yahoo.com. Most of Yahoo's services, such as basic e-mail and weather forecasts, are free. Although most of Yahoo's customers don't have any transactions in the traditional sense, one would consider site visits as the critical activity, which then would be used to measure retention for Yahoo. Thus, in the case that the customer-firm relationship is not primarily about monetary transactions, it is important to define an appropriate basis in order to measure retention.

**How Is Retention Different from Loyalty?** Retention is *not* the same as customer loyalty. Although retention is measured on a period-by-period basis and indicates whether customers are coming back, the loyalty construct has a much stronger theoretical meaning. If somebody is loyal toward a store or a brand, this person has a positive emotional or psychological disposition toward this brand. People might continue to purchase a particular brand or might patronize a particular store, but this may be purely out of convenience or inertia. In this case, someone might be retained, but the person is not loyal.

**Defection Rate** As already mentioned, the concepts of defection and retention go together. Defection rate is calculated as follows:

$$\text{Avg. defection rate (\%)} = 1 - \text{Avg. retention rate}, \quad (11)$$

Example: The retention rate in the previous example is 0.75. Thus, the defection rate is  $1 - 0.75 = 0.25$ , or 25 percent.

### Survival Rate

Another concept closely linked with retention and defection is survival. The survival rate indicates the proportion of customers who have *survived* (or, in other words, continued to remain as a customer) until a period  $t$  from the beginning of observing these customers.

Survival rate is measured for cohorts of customers, wherein a cohort refers to a batch of customers acquired within a specified period of time.

Although retention rate and defection rate reflect retention and defection, respectively, in a given period the survival rate gives a summary measure of how many customers survived

## CRM AT WORK 5.1

## AMAZON: ACQUISITION AND RETENTION

As previously noted, Amazon is one of the leaders in implementing customer relationship management programs on the Web. These programs have helped drive both customer acquisition and retention. In 1999, Amazon acquired 11 million new customers, nearly tripling its number of customers from 1998, but its greatest success in that year was not adding customers, but keeping those that it already had. Repeat customers during the year accounted for 71 percent of all sales.

Amazon has been able to acquire and retain customers at such a high rate by striving to learn about its customers and their needs and then using this information to offer them value-added features.

SOURCE: Robert. C. Blattberg, Gary Getz, Jacquelyn S. Thomas, "Customer Equity: Building and Managing Relationships as Valuable Assets" (Cambridge, Mass.: Harvard Business School Press, 2001).

between the start of the formation of a cohort and any point in time afterward. It is measured in percentage. Survival rate at time ( $t$ ) is equal to the product of the retention rate at time ( $t$ ) and the survival rate during the immediately preceding period.

$$\text{Survival rate}_t (\%) = 100 \times \text{Retention rate}_t \times \text{Survival rate}_{t-1} \quad (12)$$

In period 1, the survival rate  $_{t-1}$  is, of course, assumed to be 100 percent.

The survival rate is of great interest, because one can conveniently calculate the absolute number of survivors in a given period  $t$ . One simply multiplies the survival rate, by the cohort size in the beginning.

Example: (Number of customers starting at the beginning of year one is 1,000.)

	Retention Rate	Survival Rate	Survivors
Period 1	0.55	0.55	550
Period 2	0.62	0.341	341
Period 3	0.68	0.231	231
Period 4	0.73	0.169	169

*Computing the number of survivors:*

For example,

Number of survivors for period 1 = Survival rate for period 1  $\times$  Number of customers at the beginning

Therefore,

Number of survivors for period 1 =  $0.55 \times 1,000 = 550$

*Computing survival rate:*

Recall that

$\text{Survival rate}_t (\%) = \text{Retention rate}_t \times \text{Survival rate}_{t-1}$

In the table above, survival rate for period 2 can be calculated as follows:

Survival rate for period 2 = Retention rate of period 2  $\times$  Survival rate of period 1

Therefore, the survival rate for period 2 =  $0.62 \times 0.55 = 0.341$ , or 34.1%

**Projecting Retention Rates** Very often, we find ourselves in a situation where we would like to get an idea about future retention rates of a particular cohort of customers. To do so, we use information on past retention rates to make a prediction of future retention rates. We have already discussed that retention rates tend to increase over time. As

short-term customers drop out, the retention rate of the remaining (loyal) customers increases necessarily. This increase, however, is not linear. Almost always, retention rates tend to increase at a decreasing rate.

There is a simple method which allows us to forecast nonlinear retention rates—a simple exponential form. This approach models the retention rate as a function of time.

$$Rr_t = Rr_c \times (1 - \exp^{-rt}) \quad (13)$$

$Rr_t$  is the predicted retention rate for a given period in the future.  $Rr_c$  is the retention rate ceiling, which is the maximum attainable retention rate if unlimited resources were available. Clearly, a firm will not be able to retain all customers even if they spent unlimited advertising on them. The figure for  $Rr_c$  is typically estimated through managerial judgment. The parameter  $r$  is the coefficient of retention. This parameter determines how quickly retention rates converge over time to the retention ceiling. It can easily be estimated through spreadsheet analysis based on past retention data.

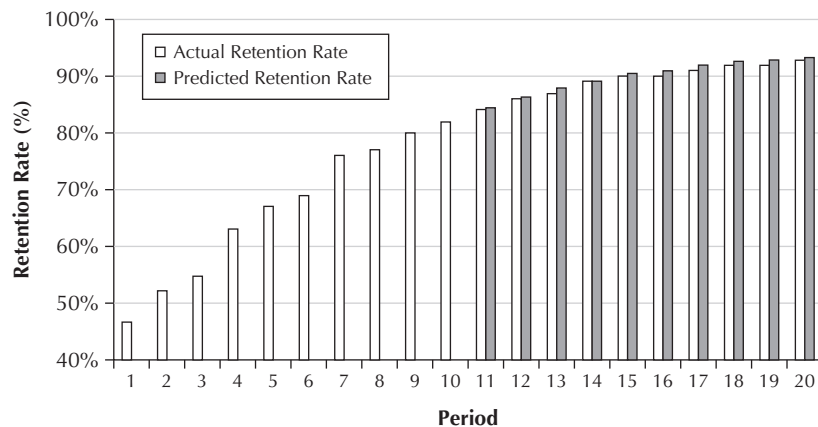
Figure 5-3 shows actual retention rates for a credit card company (white bars). The time horizon is 20 quarters. Equation 13 was applied with  $Rr_c = 0.95$ , which means that managers believe that the maximum attainable retention rate is 95 percent. The parameter  $r = 0.2$  is based on estimates that come from previous observations. Applying equation (13), the retention rates for period 11–20 were estimated (gray bars). It can be seen that the method to approximate the actual retention rates was very close.

If past estimates of the parameter  $r$  are not available, one can use another method. The retention rate  $Rr_t$  is observed for a number of past periods. Equation (13) can be regrouped to form equation (14):

$$r = (1/t) \times (\ln(Rr_c) - \ln(Rr_c - Rr_t)) \quad (14)$$

For example, the known retention rate in period 9 is 80 percent, while the one in period 10 is 82 percent. Thus, the parameter  $r$  for period 9 is  $(1/9) \times (\ln(0.95) - \ln(0.95 - 0.8)) = 0.205$ . The parameter  $r$  for period 10 is  $(1/10) \times (\ln(0.95) - \ln(0.95 - 0.82)) = 0.198$ . One can see that for both periods the parameter  $r$  approximates the value 0.2.

**FIGURE 5-3** ACTUAL AND PREDICTED RETENTION RATE FOR A CREDIT CARD COMPANY



### **Comprehensive Example**

Let's look at an actual retention pattern of a direct marketing firm. We want to illustrate the concepts of retention rate, defection rate, and survival rate. A cohort of 7,500 customers was acquired at the outset of the analysis. Table 5-1 shows the actual retention pattern for 10 periods in column 2. For example, after period 1, only 32 percent of the customers are retained into the second period. Thus, this company has a high rate of lost customers. If we are at the end of period 10 and want to make an assessment of future retention rates, we need to make a customer activity forecast.

Column 3 shows the predicted retention pattern, based on equation (13). The underlying maximum retention rate for the example is 0.80, and the coefficient of retention  $r$  is 0.5 (estimated from past data for the company). Thus, retention rates approximate the maximum rate already at period 10. This means that after period 10, the company retains approximately 80 percent of customer base from period to period. The defection rate in column 4 is simply calculated as  $(1 - \text{retention rate})$ . Finally, the survival rate, calculated with equation (12), indicates the proportion of the original cohort that survives until period  $t$ . For example, only 1.2 percent of the original cohort survives until period 11. If the survival rate is multiplied by the original cohort size—in this case, 7,500—we obtain the number of customers surviving up to period  $t$  (column 6).

Another important measure which can be derived from the information is that of lifetime duration. A simple (naïve) approach would be to calculate the mean lifetime duration from the average retention rate. The average retention rate across the 15 periods (column 2 and 3) is 71.8 percent, which results in an average lifetime duration of 3.54 periods. Since the retention rates change over time, we would have to compute an appropriate measure of average retention in order to compute average lifetime duration. More specifically, since many more customers are subject to a lower retention rate in the early periods as compared to higher retention rates in later periods, a simple average of retention rates 1 to 15 would be misleading. In the computation of an average retention rate, we need to weigh the number of survived periods accordingly. The correct average lifetime duration is calculated as follows:

**TABLE 5-1 ACTUAL RETENTION PATTERN OF A DIRECT MARKETING FIRM**

1 Period Since Acquisition	2 Actual Retention Rate	3 Predicted Retention Rate	4 Defection Rate %	5 Survival Rate	6 Expected Number of Active Customers	7 Number of Active Periods
1	32.0%		68.0%	32.0%	2,400	2,400
2	49.1%		50.9%	15.7%	1,178	2,357
3	63.2%		36.8%	9.9%	745	2,234
4	69.0%		31.0%	6.9%	514	2,056
5	72.6%		27.4%	5.0%	373	1,865
6	76.7%		23.3%	3.8%	286	1,717
7	77.9%		22.1%	3.0%	223	1,560
8	78.5%		21.5%	2.3%	175	1,400
9	79.0%		21.0%	1.8%	138	1,244
10	80.0%		20.0%	1.5%	111	1,106
11		79.7%	20.3%	1.2%	88	969
12		79.8%	20.2%	0.9%	70	844
13		79.9%	20.1%	0.7%	56	730
14		79.9%	20.1%	0.6%	45	628
15		80.0%	20.0%	0.5%	36	538

$$\text{Avg. lifetime duration} = \frac{\sum_{t=1}^T \text{Customers retained}_t \times \text{Number of periods}}{N} \quad (15)$$

Where:

$N$  = cohort size

$t$  = time period

The result of the weighing process is shown in column 7. Intuitively, it is the number of active customer periods for every period. For example, at the end of period 1 we have 2,400 (2,400 customers  $\times$  1 period) active periods, at the end of period 2 we have 2,357 (1,178 customers  $\times$  2 period) active periods, and so on. If we add all active periods and divide by the cohort size of 7,500, the average lifetime duration will be 2.89 periods. Thus, the company needs to replace its customer base every three periods, and not every 3.5 periods, as indicated before.

### Lifetime Duration

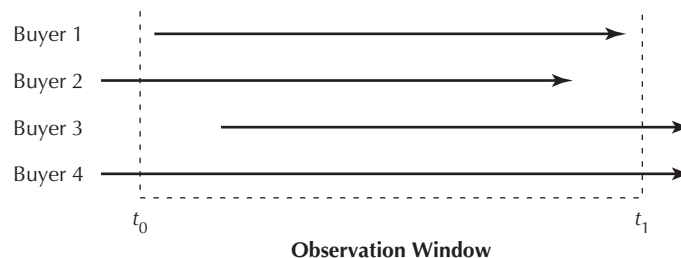
It is sometimes unclear how long a customer has been associated with a firm in a noncontractual setting, since there is no expiration date explicitly stated by the customer. In such situations, it is important to be able to predict the lifetime duration of a customer by observing buying patterns and other explanatory factors. Knowing how long a customer remains a customer is a key ingredient in the calculation of the *customer lifetime value*—a key strategic metric. Furthermore, it has implications for churn management, customer replacement, and management of lifetime duration drivers.

In calculating the lifetime duration of a customer we therefore differentiate between two cases. The first is the case of complete information. In this scenario, a customer's first and last purchases are assumed to be known. The second case is the case of incomplete information, where either the time of first purchase, or the time of the last purchase, or both are unknown. Figure 5-4 illustrates this situation.

Buyer 1 starts his relationship with the firm after the beginning of the observation window and also stops his relationship before the end of the given observation window. Buyer 2 started his relationships with the organization before his behavior was being monitored. Nevertheless, the termination of his relationship is observed. This observation is called *left-censored*. In this situation, it is unknown to the firm for how long the buyer has been engaging in the relationship *before* the start of the observation window ( $t_0$ ).

The start of Buyer 3's relationship has been observed within the observation window. However, his relationships continued beyond the end of the observation window ( $t_1$ ).

**FIGURE 5-4** CUSTOMER LIFETIME DURATION WHEN THE INFORMATION IS INCOMPLETE



Thus, it is not known to the firm at  $t_1$  how much longer the customer will in fact be a customer. This observation is called *right-censored*. Finally, Buyer 4's relationship started before the observation window and ends after the observation window. This observation is called *left- and right-censored*. Data that consist of right-censored observations require the use of survival analysis techniques.<sup>2</sup>

**Calculating Lifetime Duration** When talking about the concept of a customer's lifetime duration, not all relationships are equal. We must take the type of product, which is subject to exchange into account. Here, we are specifying the following three cases:

1. Contractual
2. Noncontractual (or always-a-share)
3. One-off purchases

Contractual relationships are those where buyers engage in a specific commitment. This commitment may foresee duration and/or level of usage. A contractual relationship that defines length and level of usage is, for example, an apartment rental lease or a cable TV subscription. A contractual relationship, which defines only length, is, for example, a mobile phone contract. Finally, a contractual relationship which defines neither length nor usage level is a credit card. This category has also been labeled *lost-for-good* because a company uses the entire customer relationship once a client terminates the contract.

Noncontractual relationships are those where buyers do not commit in any way, either in duration or level of usage. Purchasing with a department store, an airline, or a direct-mail company are examples. Since customers may use at any given time several suppliers (e.g., go to several different supermarkets), this category has been labeled *always-a-share*.

In most situations, one can unambiguously associate a particular product category with one of the previous cases. We want to caution the reader about a number of situations where the association is not as clear and where a categorization can be subject to debate.

- **Contractual case.** A contractual relationship constitutes the most straightforward lifetime duration calculation. One simply measures the time from start of the relationship (or from start of the observation window) until the end of the relationship (or until end of observation window). Since the status of the account is known, this is straightforward to calculate. For example, a cable TV subscriber opened his account on January 1, 2002, and remained active until June 30, 2004. Thus, the lifetime duration is thirty months. This example shows a case where the duration is neither left, nor right-censored (buyer 1 in Figure 5-4). If the relationship is still ongoing, we use the right observation window to calculate the lifetime duration.
- **Noncontractual case.** If the relationship is such that there is no explicit contract, buyers come and go as they please. Two different approaches are used here. The first approach emulates the calculation of a finite duration, similar to the contractual case. Towards this end, one establishes for a given point in time the likelihood a customer is still active. If that likelihood falls below a certain threshold, the customer is deemed to be inactive. A consequence of that might be that the organization stops allocating resources to that customer.

### ***P(Active)***

In a noncontractual case, given a particular customer, it may be useful to know if the customer is likely to transact in a particular time period. In other words we would like to know the probability of that customer being active in time  $t$ ,  $P(\text{Active})$ .

A simple approach for computing the probability of being active,  $P(\text{Active})$ , is via the following formula:<sup>3</sup>

$$P(\text{Active}) = T^n \quad (16)$$

where

$n$  is the number of purchases in a given period

$T$  is the time of the last purchase (expressed as a fraction of the observation period)

**Example** To compute the  $P(\text{Active})$  of each of the two customers in the twelfth month of activity, see Figure 5-5.

$$\begin{aligned} \text{Thus for Customer 1: } T &= (8/12) = 0.6667 \text{ and } n = 4 \\ P(\text{Active})_1 &= (0.6667)^4 = 0.197 \end{aligned} \quad (17)$$

$$\begin{aligned} \text{And for Customer 2: } T &= (8/12) = 0.6667 \text{ and } n = 2 \\ P(\text{Active})_2 &= (0.6667)^2 = 0.444 \end{aligned} \quad (18)$$

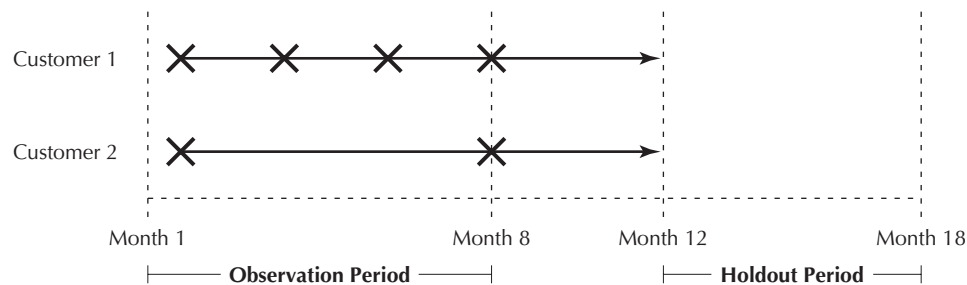
It is interesting to observe that a customer who has bought four times in the first eight months but has not bought in the last four months has a lower probability of buying in the twelfth month over a customer who has bought only twice in the same window of eight months.

There are several methods of calculating  $P(\text{Active})$ . For an advanced application, see Reinartz and Kumar (2000)<sup>4</sup> and Reinartz and Kumar (2002).<sup>5</sup>

### 5.3.3 WIN-BACK RATE

Win-back is really a part of the acquisition process. Win-back is applicable to contractual and noncontractual situations. Firms may want to measure the proportion of acquired customers in a period whom they had lost in an earlier period. This indicates either a successful communication of an important change in the product offering, service, or a change in the customer needs. *Win-back rate* is used as an indicator of success in turn-around efforts. In order to monitor win-back, a firm needs to keep track of lost customers and identify them when reentering the transacting customer base at a later time.

**FIGURE 5-5** ESTIMATION OF  $P(\text{ACTIVE})$



Note: An X indicates that a purchase was made by a customer in that month.

## 5.4 SUMMARY

Since customer value management involves allocating resources differently for individual customers based on their economic value, understanding value contribution from each of the customers to the firm is very important. In the absence of individual customer data, companies have relied on traditional marketing metrics such as market share and sales growth. Market share is defined as the share of a firm's sales relative to the sales of all firms—across all customers in the given market. It only gives an aggregate notion of category performance, but doesn't give any information about how the sales are distributed by customers. Sales growth expressed in percentage provides a relative measure of performance but fails to indicate which customers contributed more and which contributed less. The availability of customer-level data helps firms utilize a new set of metrics which enables value to be assigned to each customer. Acquisition measurement metrics measure the customer level success of marketing efforts to acquire new customers. Two important acquisition metrics are *acquisition rate* and *acquisition cost*. Acquisition rate is the proportion of prospects converted to customers, and acquisition cost is the campaign spending per acquired customer. Customer activity metrics, by contrast, track customer activities after the acquisition stage. Some critical customer activity metrics are retention rate, survival rate, probability of a customer being active,  $P(\text{Active})$ , customer lifetime duration, and win-back rate. These are important inputs for the calculation of customer value and for aligning resource allocation with customers' behavior. Average inter-purchase time is one of the preliminary customer activity metrics, and is defined as the average time between purchases. Retention rate is defined as the average likelihood a customer purchases from the focal firm in a period ( $t$ ), given this customer has purchased in the last period ( $t - 1$ ). The defection rate is defined as the average likelihood a customer defects from the focal firm in a period ( $t$ ), given the customer was purchasing up to period ( $t - 1$ ). The survival rate is another preliminary customer metric, and this indicates the proportion of customers that have "survived" (or, in other words, continued to remain as a customer) until a period  $t$  from the beginning of observing these customers. Survival rate is closely linked with retention rate. Survival rate is a summary measure of how many customers survived between the start of the formation of a cohort and any point in time afterward, while retention rate reflects retention in a given period only. It can be measured as the product of the retention rate at time  $t$  and the survival rate during the immediately preceding period. Lifetime duration is a very important metric in the calculation of the customer lifetime value—a key strategic metric. Calculation of lifetime duration is different in contractual and noncontractual situations. In a contractual case, this is the time from the start of the relationship (or from the start of the observation window) until the end of the relationship (or until end of observation window). However, in a noncontractual situation, firms are interested in the likelihood the customer is active at a given point in time. If the likelihood is less than a threshold value, the customer is considered inactive. This is given by the next metric,  $P(\text{Active})$ , which is the probability that a customer is active in time  $t$ . A simple formula for  $P(\text{Active})$  is  $P(\text{Active}) = T^n$ , where  $n$  is the number of purchases in a given period and  $T$  is the time of the last purchase (expressed as a fraction of the observation period). Win-back rate is the proportion of the lost customers acquired in a later period. Win-back rate is used as an indicator of the success of the turn-around efforts of a firm.

## 5.5 EXERCISE QUESTIONS

1. How would you calculate the retention rate of your company's customer base? What assumptions do you need to make?



2. How will you calculate the acquisition cost per customer? Consider a mail-order catalog company, an IT services company, and a retail store. What are the underlying assumptions in each case? How precise are your calculations?
3. Try to predict retention rates using equation (13).
4. How will you determine if a customer is still your customer in noncontractual settings?

**MINI CASE 5.1****AMERICAN AIRLINES USES DATABASE MARKETING  
FOR EFFICIENT CUSTOMER ACQUISITION**

American Airlines is one of the leading scheduled air carriers in the world, running both passenger and cargo services. The company operates on a worldwide basis with services to major cities in Europe, Canada, Mexico, the Caribbean, Central and South America, Asia, and across the United States. American Airlines is headquartered in Fort Worth, Texas. The company was the first to implement a frequent flyer program (AAAdvantage), and today, the program is the largest in terms of members. Besides using the program to induce current members to spend more of their flight dollars with American Airlines, the company uses the program to efficiently target new prospects and to convert patrons of competing airlines. One example of this strategy is the cooperation with the credit card company American Express. Through the collaboration with American Express, American Airlines tries to identify attractive customers who are not American Airlines flyers. Take the example of the Southeast Asian route from Los Angeles to Tokyo. American Airlines obtains data from American Express about customers who live in California and who are using their Amex card in Japan. This list of customers is compared with the actual list of AAAdvantage members who are flying to Tokyo. Naturally, there will be customers who do not appear on AAAdvantage's member list. These are obviously premier targets for American Airlines, as they apparently fly to Tokyo but do so with a competing carrier. These prospects will then get attractive offers inducing them to try American Airlines. American Airlines has been very successful in targeting attractive prospects fly to large number of destinations.

**Questions:**

1. How does American Airlines know whether this new practice works (i.e., is successful in acquiring more customers than previous methods)? Which performance indicators do you need to measure in order to document this?
2. Explain how exactly American Airlines can compute return on marketing spend with this new practice.
3. Do you think American Airlines' practice is a benefit or a cost to the consumer?

**APPENDIX I****Notation Key**

Notation	Explanation
$i$	buyer with the focal firm
$I$	total number of buyers with the focal firm
$k$	buyer in the market
$K$	total number of buyers in the market
$n$	customer in cohort
$N$	cohort size
$j$	firm
$J$	total number of firms
$S$	sales (value)
$V$	sales (volume)
$c$	category
$t$	time period
$T$	length of horizon
$Ar$	acquisition rate
$Rr$	retention rate
$Dr$	defection rate
$Sr$	survival rate
$Ar_c$	acquisition rate ceiling
$Rr_c$	retention rate ceiling
$r$	coefficient of retention
$a$	coefficient of acquisition
$P(\text{Active})$	the probability of the $i^{\text{th}}$ customer being alive or transacting in period $t$

**ENDNOTES**

1. The terms *lifetime duration*, *customer lifetime*, and *customer tenure* are often used interchangeably.
2. Survival analysis techniques allow us to examine the relationship of various variables that affect the lifetime duration in a firm-customer scenario when observed variables are right-censored.
3. David C. Schmittlein and Donald G. Morrison, "Is the Customer Still Active?" *The American Statistician* 39, no. 4 (1985): 291–295.
4. Werner Reinartz and V. Kumar, "On the Profitability of Long-Life Customers in a Noncontractual Setting: An Empirical Investigation and Implications for Marketing," *Journal of Marketing* 64, no. 4 (October 2000): 17–35.
5. Werner Reinartz and V. Kumar, "The Mismanagement of Customer Loyalty," *Harvard Business Review* (July 2002).