

NON-PARAMETRIC ESTIMATION OF MEAN CUSTOMER LIFETIME VALUE

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This paper is about how to use data from a random sample of customer relationships to calculate an appropriate average customer lifetime value (CLV). When the sample contains only completed relationships, the simple unweighted average is appropriate. When the sample contains a mix of active and completed relationships, the lifetimes of the active relationships are said to be right censored because the observed lifetime to date is but a lower bound on the eventual lifetime. Because of this censoring, a simple average of the sample CLVs to date will be a biased estimate of the mean CLV. This paper presents and explores several non-parametric estimation methods for correcting for this bias.

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INTRODUCTION

This paper is about how to calculate an appropriate average customer lifetime value (CLV) for a sample of n customer relationships. Although there are a host of articles describing how to calculate CLV as a function of retention rates, gross margin per transaction or per period, remarketing costs, and a hurdle rate (see, for example Berger & Nasr, 1998; Blattberg & Deighton, 1996; Dwyer, 1989; Hughes, 1997; and Pfeifer & Carraway, 2000), very few articles offer advice to managers on how to estimate the necessary inputs (Berger, Bolton, Bowman, Briggs, Eleten, Kumar, Parsuraman, & Terry, 2002 is a notable exception). As suggested by Jain and Singh (2002, p. 44), “research is needed into estimation methods that provide stable, consistent, and unbiased estimates (of CLV).”

The purpose of this paper is to begin to do just that by addressing the question of how to use customer-level data to estimate an average or mean CLV.

To be more specific, this paper addresses how to use data from a random sample of n customer relationships to estimate the mean CLV of the population of relationships from which the random sample was drawn. For example, if the n relationships all came from a particular source, then the mean of the population represents the long-run average CLV of relationships from this same source. Although the random-sample assumption might seem unduly restrictive, it is the usual assumption invoked whenever one uses data to draw inferences about a population. The construction of confidence intervals, for example, requires this random-sample assumption.

The mean CLV is of particular interest to interactive marketers because it represents the long-run average (dollar) value of a relationship from the population. The mean CLV is the metric used to make informed prospecting decisions in that it represents a limit on spending designed to initiate new relationships from the population. So, for example, after a cruise line estimated a surprisingly high mean CLV of \$4,581 for its population of new customers, it decided to adjust its acquisition spending upwards (Berger, Weinberg, & Hanna, 2003).

The mean CLV is usually sufficient for making marketing decisions affecting groups of customers

(prospects) when it is either infeasible or uneconomical to capitalize on individual differences. Prospecting decisions about media, copy, promotions, and sales force can often be made based on how each of these affects the average CLV of the customers acquired without regard for individual differences.

Even decisions about how to treat existing customers are sometimes made based on group averages. Consider a firm conducting an experiment to decide how to treat a segment of customers reaching a specified milestone (e.g., their first called-in complaint, the graduation of their oldest child, or their first missed payment). The firm might apply treatments A and B randomly to the next several customers reaching the milestone, track the subsequent performance of two groups, and calculate the average CLV (discounting all future cash flows back to the point at which the treatment was administered) of the two groups in order to identify which treatment worked better.

By CLV, we mean the present value of the future cash flows attributable to the customer relationship over the lifetime of that relationship (see Pfeifer, Haskins, & Conroy, 2005). Thus, the specification of CLV requires a careful delineation of a starting time point so as to be clear about what cash flows are in the future (and included in CLV) and what are in the past (and not included in CLV). For the purposes of this paper, it is important that the CLVs calculated for the sample customer relationships all use a common starting time point in the firm’s relationship with the customer. Often that start point is right before the receipt of the initial revenue from the customer. Customer lifetimes (or survival times) are usually measured relative to the time the firm acquired the customer. An implication of the random-sample assumption is that the calendar time of customer acquisition can be ignored. It is also important that all sample CLVs be calculated in a consistent manner across customers and throughout the study period.

Finally, we will assume that CLV is defined using a finite horizon, H . The cash flows over at most H periods will be included in CLV. This means that customers active for more than H periods will be treated as if the relationship ended at H . The finite horizon assumption is one of convenience and statistical necessity.

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