

# Financial Modelling of Customer Value

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## Abstract

We present work that applies financial engineering and statistical techniques in a novel way to the valuation of a firm's customers. Portfolio and options theory are used to analyse time series of customers' future profit data. We follow with a discussion of the tools that can be used to gain a view as to the likely form of the time series of customer's future profits. These include complex adaptive system representations such as Agent Based Models and distributed reasoning methods such as ideas markets.

**Keywords:** financial engineering, portfolio theory, options, agent based modelling, ideas markets.

## 1. Introduction

Many companies use customer satisfaction measures as a means of evaluating a company's performance. The justification for this is the belief that low customer satisfaction is a direct driver for churn, i.e. it will increase the propensity of a customer to leave a company, and therefore negatively impact profitability. However, some of the recent research has indicated that simply measuring customer satisfaction can be misleading. Reichheld (2003) states that in an average company 84% of customers are satisfied but only 41% are loyal. 60-80% of customers will claim to be satisfied and then leave. Soderlund and Vilgon(1999) also present empirical evidence that shows there is only a weak and non-significant link between customer satisfaction and profitability.

In addition to satisfaction, loyalty is often cited as an important customer measure and viewed as a key driver of value and profitability. However, there are some difficulties with using loyalty as a metric: how do you quantify customer loyalty? And what is its impact on profitability? Reinartz and Kumar (2000) show that it is an oversimplification to assume that long-life (loyal) customers are more profitable and that both long and short life customers can be highly valuable. Evidence that shows the link between customer loyalty and profitability is only weak and the usual arguments for investing in loyalty programmes don't stand up to examination. Contrary to popular

belief loyal customers do not cost less to serve, they do not pay a higher price for the same bundle of goods and the link between customer longevity and word-of-mouth marketing is only weak.

If the links between satisfaction or loyalty and profitability are only weak, these measures alone do not provide sufficient information to manage customer relationships in a cost-effective way. A company that focuses on metrics such as satisfaction, retention rates and purchase frequency without any consideration to the underlying value of their customers risks overspending on low value relationships and generating lower levels of profitability.

We suggest that the value of customer loyalty should be considered as the financial value of a customer over its lifetime. Understanding the current and potential value of customer relationships is vital for developing profitable customer relationships.

Customer lifetime value can enhance traditional customer satisfaction metrics by giving a financial measure that indicates the expected future value of a particular customer relationship. It can help decision makers understand how much is being lost due to churn and allow them to manage customer relationships in a financially viable way. It can identify potentially high value customers for targeted up-selling or cross-selling campaigns or enhanced services aimed at prolonging profitable relationships. It can also identify unprofitable customers or those with particularly low profitability, these individuals can then be targeted in promotional campaigns to increase spend or be managed in a low cost manner. The notion of the customer value can also be extended to consider its modification due to risk associated with the customer's future profit stream. This can also guide decisions on the nature of investments in customers.

The value of individual customer relationships within an organisation ultimately determines the overall value of the business. Therefore, it is sensible to consider customer value with regard to tactical decisions and as a strategic metric to measure the overall value of a firm.

## 2. Customer Lifetime Value (CLV)

There are a number of basic techniques for valuing customers. We focus on Customer Lifetime Value (CLV). CLV, as the term suggests, looks forward and calculates the net present value of the expected customer's cashflow over an extended period in the customer relationship. Equation 1 shows the basic form of the calculation of CLV.

$$CLV = \sum_{t=0}^{\infty} (m_t \frac{1}{(1+i)^t}) - c \quad (1)$$

Where,  $m_t$  is the margin,  $i$  is the discount rate,  $c$  is the acquisition cost and  $t$  is time.

With this basic measure, customers or segments that yield a positive lifetime value are considered economically valuable to the organisation.

CLV, as a discounted cash flow calculation, is useful in its own right. It has acceptance in finance and increasingly in marketing circles. It is easy to understand and produces straightforward cash values for a customer.

### 2.1. Customers as Equity

The CLV approach to valuing customers creates an interesting conceptual framework. The equity value of a company i.e. its market capitalisation or the sum of its shares is ultimately determined by the sum of its future cash flows, discounted at an appropriate rate. Clearly the value of most companies is determined by the value of its customers, which is the sum of the CLVs. Although the message that the financial fate of the company is down to its customer base is hardly new, it does bring it home. This way of thinking should encourage a more rational, and sustainable mode of strategy development. We will develop these ideas further.

### 2.2. A Sustainable Way of Thinking About the Business

The CRM consultants Peppers and Rogers (2004) have coined the term "return on customers" and are espousing the view of customers as equity. They argue that when companies assess their performance they most often consider their total income. They do not consider the changes in the value of their customer base. Future income is obviously considered, however there is a lack of direct relation between future income and the treatment or development of the customer population that will deliver it. Peppers and Rogers (2004) suggest that companies and their managers

should be held accountable for preserving and increasing the value of the asset that is their customer base. Performance measures should include the current profits added to the change in value of customer equity which should include enhancement of the value of existing customers and the addition of new ones. Return on Customers (RoC) for a set period can be defined as the change in this performance measure divided by the total customer equity at the beginning of the period. A company that has a high RoC makes decisions based on long term sustainable profits.

The description of the value of a firm's customer base in terms of an equity value is important as a means of reinforcing the critical role customer loyalty plays in the long term fortune of a company.

The notion of customers as a form of equity also allows the application of finance concepts to the analysis of CLV.

One of the most important extensions permitted by this work is the inclusion of the effects of uncertainty in the future value of customers. Options theory and portfolio theory are tools that can be used to gain additional insights into this extra dimension to their value.

### 2.3. Portfolio theory

Using the analogue of a customer as a unit of equity, it becomes possible to consider a company's customer base as a portfolio of assets. Each of these assets, like financial securities, will have different value dynamics. Each customer will give different levels of return and volatility or uncertainty in that return. Portfolio theory, arising from work of Markowitz (1959), allows for quantitative analysis of the risk and return of a collection of assets making up the portfolio. In addition to the different risk and return characteristics, there are also expected to be correlations and anti-correlations in the returns of the different elements of the portfolio. For instance, the spending of a customer is likely to be influenced by external economic factors. Different customers can be affected in opposite ways. An example with enterprise customers is response to changes in oil price. Oil companies profits increase as the price of oil rises however with purchasers of oil, such as airlines, profits are negatively affected. Oil companies are therefore likely to spend more and airlines less as a result of increased oil prices i.e. their value as assets in a portfolio are anti-correlated. The reverse will also happen as the price of oil drops. This sort of behaviour in values is also experienced with retail customers in different geographic regions, subject to differing changes in levels of employment and economic prosperity. Combining anti-correlated assets allows

control of the stability or risk of the overall profit stream. Knowing these basic characteristics, a portfolio can then be constructed that will give a specific overall risk and return character. Portfolio theory shows that there are optimum combinations of assets to achieve a certain risk and return character.

Using this approach we can then ask questions such as, what might be the appropriate customer retention and acquisition strategy to create a portfolio with desired properties for a particular company. The value of a potential new customer or one that you already have is dependent on their expected CLV but also on the effect the customer's profit flows have on the performance of the portfolio as a whole.

Dhar and Glazer (2003) describe an example of using these concepts for the choice of target customers to complement the existing customer portfolio of a manufacturing company. In their example, the CLV of the existing customer base and that of two potential target customers are estimated, based on historical data and scenario planning taking expected future economic factors into account. The level of uncertainty in the magnitude of the CLV figures and how this is correlated to that of the existing customer base, are also estimated. By conventional analysis of the CLV, one of the customers appears to be slightly more desirable. The other potential customer is shown to generate similar expected future profits but is anticipated to be anti-correlated with changes in the existing portfolio. The acquisition of this customer will give similar total profits but with a lower total risk for the whole customer portfolio. The value of the customer to be acquired is therefore partly dependent on its contribution to profits and partly on how its future profit flows complements that of the future profit flows of existing customers.

This has interesting implications. It means that the way segmentation is performed should be modified to take this into account. Customers that by conventional analysis may appear to be desirable, may actually have a negative impact on the portfolio of customers as a whole. Ironically the less the customer characteristics are like those of portfolio the greater the contribution to the stability of the portfolio and hence the more significant this aspect is to the value a customer has.

By using the portfolio ideas, a marketer should be able to increase the probability of meeting profit targets and achieve more reliable levels of profits. The increased accuracy of the valuation of target customers means that more appropriate levels of marketing investment can be made. It also means that since your portfolio is likely to be different to that of your competitors, different customers will have different values to them. With analysis of your competitors you should be able to calculate this difference in value and

use this to guide decisions in competitive tender situations. The technique requires a good understanding of the expected future profitability of customers. Therefore information gained from CRM systems that can be used to form this understanding has additional commercial value. This can be used to help place values on CRM data and CRM systems either from the point of view of purchaser or seller of CRM data and CRM systems. The technique can also be used to understand the likely impact that future changes in a company's customer base may have on the profitability and risk levels. Demographic and socio-economic changes to a company's customer base over time would be an example.

Other potential effects of stability in company profits from its customer portfolio are as follows. For many companies a more predictable revenue stream is usually desirable. Investments can be predictably financed giving a more efficient use of funds. Company resources will achieve higher levels of utilisation. Employee moral will be higher leading to greater productivity and better customer service. The company will be less vulnerable to take over caused by dips in revenues leading to excessive share price reduction. Stable revenues are likely to give improved credit ratings, subsequently lowering the cost of borrowing.

## 2.4. Options

Using the data set shown in figure 2, we now give an example of how options theory concepts can be used to analyse business data, in this case a time series of profit data for a customer.

One question that can be addressed is at what point is it economically correct to abandon a profit generating asset, i.e. when does it actually become loss making, when its associated profit stream is subject to random fluctuations. In this case the asset is a customer, but the concepts can be equally applied to any asset such as a factory machine, share etc.

The data that we have obtained in figure 2, shows random fluctuations in the revenues and a constant drift downwards in time. This type of statistical behaviour can be modelled using Brownian motion with drift. Options analysis shows that the abandonment value of the example customer in figure 2 is negative £10.60. This means that the customer should not be considered unprofitable if the revenue reaches the conventional break-even threshold, because due to the variation in their level of revenues there is a significant chance that they will become positive again. The customer will on average remain profitable unless the trend line drops £10.60 below the break-even point. Essentially this corresponds to the

value of retaining the option of receiving future revenues from the customer before making the irreversible decision to lose the customer.

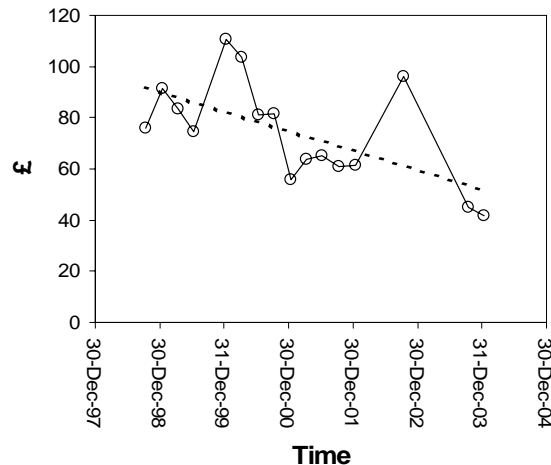


Figure 2: Quarterly profit data for a single customer. Dotted line shows the linear trend line. Key statistics are the drift rate of -£1.91 per quarter and standard deviation of changes in revenue of £15.58 per quarter.

For many companies, actively encouraging customers to leave is an action that cannot be taken for regulatory or negative publicity reasons. However the results of this analysis can help classify unprofitable customers in a more intelligent way. This information can then be used to guide decisions about interactions with customers such as at what point should investment in them be increased or stopped. The good news is also that in general, customers that may have appeared unprofitable by simple metrics are actually profitable.

Extensions to the analysis includes the consideration of the possible effects of attempts to improve the profitability of a customer. This would be a jump in profitability with a certain probability, the size and probability depending on the type and likely success of an investment event. This would allow more effective planning of investments in a customer, for up-selling and cross-selling attempts, for instance.

Options analysis can be applied in a wide range of ways to the problem of valuation of customers and to the guidance for investments decisions in them.

### 3. Estimating the Future Profit Time Series

In these analyses, a view as to how the magnitude, volatility and duration of the revenue streams vary is required. This could be achieved by using historical data and extrapolating them into the future. The most useful data would be that which showed how the revenues alters in the future as a result of a strategic intervention or change in market condition. Simulation models of customer populations, that describe the behavioural aspects of customers could provide some insight into this. Agent Based Models are such simulations. However these cannot provide an exact prediction. If it could then obviously this is the only tool that would be required to quantitatively determine the lifetime value of customers.

#### 3.1. A Stock Market for Customers

An additional guide to customer lifetime value could be obtained through the use of a form of stock market. The problem of valuing the CLV is that it is future looking and subject to changes due to external influences. The collection and interpretation of this information is a complex task. Markets such as stock markets are extremely efficient at performing this task. They aggregate information and opinion from large numbers of inputs that determine the price of the stock on the exchange. This principle has been used in a number of analogous contexts. The Hollywood Stock Exchange is a nice example of this.

In the Hollywood Stock Exchange no money is traded but users can buy and sell investments in movies or movie stars using "Hollywood Dollars". The intention is to make as much of this pretend money as possible, trying to predict which way a movie or movie star may gain in popularity or financial worth, which is ultimately related to the total future revenue stream for that movie. The results of the market movements are used by the movie industry to tap into the opinion and information of the general public. They use it to predict the success of movie and hence alter promotion strategies and decide whether to drop or more heavily promote a movie.

This approach could be used internally by companies. The future revenue streams associated with customers is difficult to estimate due to the external factors affecting the market. These could be the emergence of competitive offerings, changes in fashion and broader economic factors amongst others. Members of the sales force could take part on a customer market which could act as a guide to changes in the future value of a company's customers. A similar approach has been adopted by Hewlett-Packard

with their sales force where a market was used to predict the total sales, Plott and Chen (2002).

## 4. Conclusions

Customer lifetime value is a useful measure for determining the value of customer loyalty. It is straightforward, giving a cash value to the future profit stream for a customer. It can be used to value the loyalty of individuals, groups, segments or enterprises. As a discounted cash flow calculation it is understood and accepted by the finance community and is increasingly recognised in marketing circles. Its use as a basic measure is valuable due to its clarity and simplicity.

What is interesting are the implications of this view on valuing a customer. The discounted cash flow interpretation enables the customer to be considered as equity which reveals the direct link between the customer and the equity value of the company it is served by. It shows the importance of cultivating the customer and enhancing its long term value since this impacts on the long term value of the company itself.

If customers are considered as a form of equity, then it becomes natural to extend the analysis of their value using tools and approaches from finance. The tools of portfolio theory and options analysis are useful in this regard. These approaches allow value to be attached to the future uncertainty in the customer profit streams.

Portfolio theory exploits the correlations and anti-correlations between different customers in a customer portfolio, in response to external influences such as economic factors or even marketing efforts. The effect potential customers may have on the overall performance of the portfolio of customers can be used to give additional value to a customer. This information can be used to guide decisions on whether a potential customer should be targeted for acquisition and what level of investment should be used.

Options analysis can be used to calculate expected future value of a customer and guide the timing and level of investment in a customer. It can also be used to calculate the true level of profitability of a customer. This information can be used to make decisions on service levels and whether up-selling or cross-selling strategies should be used.

A number of approaches exist to estimate the future behaviour of customer profit streams. Along with the traditional simulation and statistical extrapolation techniques, ideas markets provide an interesting alternative. This technique completes the view of customers as a form of equity and has been proven to be of greater accuracy than conventional techniques.

As a measure of the value of customer loyalty, CLV is valuable in its simplicity and fundamental focus on the profitability of customers. CLV, in allowing the interpretation of customers as a form of equity is an innovative step forward. The ability to extend its analysis using tools and concepts from finance creates additional insights into the value of customer and with it the opportunity to make better decisions on investments in the customer base.

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