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CLV Evaluating Model for B2C High-Risk Markets

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Abstract. Researchers found some models for calculating CLV (Customer Lifetime Value), but a lot of these models are based on simple NPV (simple net present value). However simple NPV can assess a good value for CLV, but simple NPV ignores an important aspect of B2C markets which is market risk affecting customer cash flow. Therefore, simple NPV isn't enough for assessing CLV in high risk B2C markets. This paper contributes a new CLV calculating model that is accurate in B2C high risk markets, because environmental risk is included in this model. Real options analyses in this paper are suggested different situations for B2C relationships that are affected by environmental risks. By applying real options analyses to CLV, the paper offers a new approach that assesses an accurate CLV in B2C high risks markets.

Keywords: Customer Lifetime Value (CLV), Environmental risks, Real options analyses, B2C Markets.

1. Introduction

CLV is an important parameter in B2B and B2C relationships. Managers could make better decisions to segment customers by CLV. The majority of contributions that investigate CLVs are based on simple net present value (NPV) considerations. Using simple NPVs to assess CLVs, the supplier discounts future cash flows from a specific customer to the present date, while deducting the investment expenditure associated with the customer. Despite of its broad acceptance, NPV isn't most appropriate approach with which to value customers in relationships. The most important reason for this inappropriate is regarding the environmental risks (such as fluctuations in demand, changing customer needs, technological change, changing prices and production costs). Consequently, simple NPV analyses could assess CLV when the market has no environmental risks, and we can't use NPV-based models in real high-risk markets.

In this paper, at first we introduce the history of CLV models, and their problems in high risk markets. Then, we describe customer's behavior in B2C markets, and define a period of time for customer's buying. Then, we estimate customer cash flows in future, by using history of customer's behavior. After that, real option analyses adapt the estimated future cash flows, to find accurate customer lifetime value in future. In this paper we complete our CLV model in three steps. In each step, our model will be improved and calculates more accurate value. And in third step, we introduce an accurate CLV model for B2C high risk markets by applying real option analyses. Finally, we compare CLV models in B2C and B2B markets.

2. History of CLV Models

Since Bursk's article "View your customers as investments" in 1966, a number of scholars have adopted the idea of using NPV-based analyses to assess the value of customers in relationships[1]. In 1985, Jackson differentiated customers to lost-for-good and always-a-share. Lost-for-good customers buying with high switching costs therefore they are reluctant to switch suppliers. These customers are committed to only one vendor. But always-a-share customers may buy from more than one supplier. Switching costs are lower for the latter group than the lost-for-good customers. Jackson suggested calculating different versions of NPVs to explore the value of the two customer groups[2].

Many recently publication about evaluating customer based in NPV and simple NPV. The difference between present values and net present values is that opposite to the present value, the net present value concept takes investment expenditures into account[3]. In 1998 Berger and Nasr used NPV to model customer lifetime value. They mathematically modeled the CLV when customer contributions and production costs are non-constant as well as customer migration. They demonstrated their models with numerical examples[4]. In 2001 Jacobs, Johnston and Kotchetova used a NPV based model in B2B context for calculating CLV[5]. Customer value also was evaluated in B2C context by Reinartz and Kumar in 2003. To calculate CLV, they used the present values of the customers' estimated contribution margins[6]. Adams (2004) demonstrates a new model for CLV by using real options to assess customer equity. In this model Adams show how the real options approach could be applied to assess an insurance firm's customers equity[7].

Consequently, most of these models calculate CLV by (simple) NPV. And there isn't any attention to environmental risks in these models. If customers' cash flows remained largely unaffected by risk, NPVs would be the correct assessment method. Since many markets are currently uncertain, simple NPV methods need to be extended to assess uncertain CLVs correctly. Our method uses real option analyses to evaluate customer in B2C high risk markets.

3. Customer's Behavior in B2C Markets

Number of customers in B2C relationships is more than B2B relationships then for a simplified model, we need to divide costumers into different types. Depending on period of time between a customer's purchases we propose different customers to assess CLV.

Table 1 diffrent types of customers

Type	customer's purchases	Period
1	These customers buy every week	1 week
2	These customers buy every two weeks	2 weeks
3	These customers buy every three weeks	3 weeks
4	These customers buy every four weeks	4 weeks
5	These customers buy sometimes	10 weeks

In table 1, different types of customers are shown and period shows the period of time, which we consider for each type. Customers in type 1 are very good and loyal customers and customers in type 5 aren't very important in a B2C market. Let q_t be amount of customer's purchase in one period, then we have q_0 for current period and q_t , $t=-1,-2,-3,$ ... for previous periods down to the first period of customer's purchase[1]. Equation 1 calculates μ average rate of customer's purchase for *n* periods (from now down to the first period) and equation 2 calculates σ^2 variance rate of customer's purchase.

$$\mu = E(q_t) = \frac{\sum_{t=0}^{-n} q_t}{n}, \qquad (1) \qquad \sigma^2 = Var(q_t) = E[(q_t-\mu)^2] = \frac{\sum_{t=0}^{-n}(q_t-\mu)^2}{n}, \qquad (2)$$

History of customer's behavior impact on customer cash flows in the future, this is the base of most CLV models [8][9]. To assess the CLV, the customer's purchase should be estimated for different future states of the world, weighed with probabilities and discounted to the present date. If q is uncertain in each future period, we can assume that in future the customer's purchase is related to past periods. In this sense, amount of purchase follows a stochastic process in which the initial volume is known today, but future volume is unknown (stochastic)[8]. We have chosen normal distribution for volumes in future as it is easy to use and can span a large range of applications [10] [11]. If future cash flow is modeled as a normal stochastic process, probabilities for different future states can be mathematically derived from the stochastic processes. We use μ and σ^2 that calculated in equations 1 and 2 as parameters for normal distribution. Then we can estimated q_t , t=1,2,3,… for future periods, it shows in equation 3. When we determine μ and σ^2, then we could produce normal distribution numbers by using software like MATLAB or Minitab or....

$$q_t = Norm(t; \mu, \sigma^2 \quad , \qquad (3)$$

In the other side, there is a discount rate which discounts future cash flows or customer's purchase. Determining an appropriate discount rate is usually difficult. Customarily, companies expect rate of return

1 Series of q_t could be calculated from customer's database

for an equivalent investment in the capital market[8]. For simplicity, we assume that future margins will be discounted at the risk-free interest rate i (like most of other CLV models)[12]. To assess the CLV, the supplier considers n future periods. The CLV (step 1) can be calculated as a simple present value formula given in equation 4.

$$CLV(step1) = \sum^{n} \frac{q_t}{(1+i)^t}, \tag{4}$$

But step 1 has a big problem. It shows amount of customer's purchase not supplier's profit, we must subtract supplier's costs to determine accurate CLV. For this purpose, we assume x as a percentage of customer's purchase that is equal to supplier's profit (e.g. 10% or 15%)[2] . Equation 5 shows CLV (step 2).

$$CLV(step2) = \sum^{n} \left(\frac{x.q_t}{(1+i)^t}\right), \tag{5}$$

But yet, there is another problem in step 2. This is increasing or decreasing future customer's demand in high risk markets. Real option analyses could considers all the future states [15] and solve this problem. In the next step, we use real option analyses to determine another factor (F_t) and multiply F_t with amount of customer's purchase in each period, and then we find the accurate amount of customer's purchase in high risk markets.

4. Real Options in Future

In a real high risk market, the future demand can go either up or down. Customer cash flows are affected by environmental risks in many guises. Risk can appear as operational risk due to the nature of a firm's business activities, country risks, risks from competitors' actions, technological risk and demand-side risks[14]. All types of risk result in fluctuations in demand, price and/or costs and thus have an immediate impact on the customer's cash flows. To keep our analyses simple, we focus on demand risk that affects customer cash flows and thus follow other papers recommendation to treat risks separately[8][15]. Many markets are affected by demand risk, which complicates the projection of future cash flows. Demand for products that require high investments in production can fluctuate with a country's economic situation. Moreover, firms developing and launching new products are confronted with high demand risk because future demand is difficult to forecast[8].

To assess the CLV, the demand should be estimated for different future states of the world, weighed with probabilities and discounted to the present date. We can assume the future demand can go up or down. As we said before factor F_t is the key for this purpose. F_t shows the probability of increase or decrease in each period. Then equation 6 shows the CLV model in step 3. In this step each period multiply with F_t and this equation considers increasing or decreasing in future demands in a real high risk market.

$$CLV(step\ 3) = \sum^{n} \left(\frac{F_t.x.q_t}{(1+i)^t}\right), \tag{6}$$

For F_t we have chosen a binomial approach for increasing or decreasing future demand as it is easy to use and can span a large range of applications (this corresponds to [8][13]). If future demand is modeled as a binomial stochastic process, probabilities for different future states can be mathematically derived from the stochastic processes. Demand is known today but uncertain in future and follows a multiplicative binomial process in which demand can either improve by factor u>1 in future, or decrease by d< 1. Therefore, F_1 at period t_1 is either u or d. The probability p of an increase in demand in the next period can also be derived from mathematical process. It is clear that if p is probability of increase in next period then $(1-p)$ is probability of decrease in next period. Then at period t_1 the customer purchase must be multiplied with $F_1=(p.u+(1-p).d)$ and in other periods the customer's purchase must be multiplied with $F_t= (p.u+(1-p).d)^t$. This binomial approach is used in many papers that estimated future demands with real option analyses [8][13][15]. Equation 7 shows our final CLV model (step 3).

[2] This percentage depends to market's type or other parameters.

$$CLV(step\ 3) = \sum_{t=1}^{n} \left(\frac{(p.u+(1-p).d)^{t}.x.q_t}{(1+i)^t} \right) \qquad ,7$$

As it can seen in above equation, in this model different future potential demands are calculated (e.g., $u^3.q_3$), multiplied with the supplier's profit x, weighed with probabilities p^3 and discounted to the present date. If upward and downward factors converged towards each other so that $u=d=1$, demand would remain constant and CLV (step 2) would overcome. Similarly, if p converged towards 1, the future upward state would become certain and step 2 would again overcome.

5. Comparing CLV Models in B2C and B2B Markets

This paper is second paper of our series of papers in developing a CLV valuation model based on environmental risks. In our first paper in this sequence, which is used in ref. 9, we describe our model for B2B high-risk relationships. On that paper, we divided B2B relationships into four different types, and introduce a CLV evaluating model for each type. That paper used real option analyses to find accurate customer value in B2B markets. That model had some limitation that makes it suitable only for B2B markets. In this paper we change our approach and develop a model based on real option analyses for B2C markets. The aim of this paper is to develop a CLV valuation model by considering environmental risks in B2C markets. Comparing these CLV models in B2B and B2C relationships lead us to two differences:

1- Usually, in B2B markets buying are done on long term or mid term contracts, then amount of buying and number of customers approximately are constant and pre-defined in contracts. Then estimating future demand is easier than B2C markets. We used only binomial distribution to determine how environmental risks make future demands to grow up or down in B2B markets. But B2C relationships almost haven't any contract and customer's demand fluctuates in future very fast. Then at first, we must estimate future demand by using normal distribution (average and variance calculated by history data of the customer) and then adapted it with a binomial distribution to show how environmental risks make demands to grow up or down in B2C high risk markets.

2- In our previous paper we discussed about supplier's flexibility that is very important in B2B relationships. If supplier is flexible when customer's demand grows up, it will respond to the increasing demand. But if supplier's investment is limited, it won't respond to the increasing demand [8]. On that model we subtracted capital expenditure from customer value to calculate accurate CLV. Then our CLV model in B2B markets suggests to increase or decrease investment for a customer. Therefore, CLV model is a good way to make investment strategy in B2B relationships. But in B2C markets we face to a big majority of customers, and our CLV model in B2C market divides customers into appropriate segments. In this way, company could make different marketing plans for different segment of customers. Therefore, CLV model in B2C markets could make good marketing strategies instead of investment strategy.

6. Future Works and Studies

Our model evaluates customer in high risk B2C markets. It works very accurately because it uses real option analysis to determine customer's future cash flows in each period of time. But there are two limitations in our models, that could be solved in future works.

The first limitation is that input parameters have to be estimated for the valuation metrics and are thus subject to an estimation error. Various estimated data are necessary to assess the CLV in buyer–seller relationships. Real option model is highly sensitive to the underlying input parameters such as probability of increase or decrease demand in the future (p), increase or decrease factor for demand in next period (u,d) and discount rate (i). In the case of financial options, these parameters could be determined from historical market data. In the context of real options, these data are sometimes difficult to obtain, especially if the asset is not traded and market data are not available for the asset. Consequently, the necessary data have to be subjectively estimated and could be a source of error[16]. For future works it is a good idea to develop a model to estimate these parameters, accurately.

Secondly, Our CLV analyses were based on economic parameters. Soft factors such as trust, social bonds or closeness that contribute to CLVs in relationships are difficult to include, as they are generally difficult to quantify[8]. However, they may be introduced as moderating variables on a qualitative basis.

7. Conclusion

We develop a new CLV model to evaluate customer value in B2C high risk markets. Real options analyses help us to determine exact future cash flow of a customer and calculate more accurate CLV than NPV-based models, it lead us to binomial distribution that estimate future increased or decreased demands. One of the most important consequences of evaluating customers in our model is better decision in marketing management. This model is a good way to segment customers. By suitable segmenting, we can use better marketing strategy for each segment. In addition, if customer relationship management (CRM) systems use CLV model to evaluate customers, those could suggest better ideas for managing relationships between companies and their customers[17]. This paper's CLV model could be used in many CRM systems. And this model lead CRMs to better decision in high risk and real markets.

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