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A New Model for Evaluating Customer Lifetime Value in High Risk Markets

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***Abstract*—There are some models for calculating CLV (Customer Lifetime Value), but most of these models are base on simple NPV (Net Present Value). However, simple NPV can assess a high-quality value for CLV but simple NPV ignores three important aspects of markets which are market risk affecting customer cash flow, flexibility of a firm reacting to these changes and cost of customer attraction and cost of customer retention. Therefore, simple NPV might not be sufficient for assessing CLV in high risk markets. This paper is going to suggest a new CLV calculating model with the superior accuracy in high risk markets because, environmental risk, supplier's flexibility and cost of customer attraction/retention are included in this model. In this research, real options analysis is suggested to level the CLV model accuracy for relationships that are affected by environmental risk in which suppliers are flexible. By applying real options analysis to CLV, a new approach is recommended to assess an accurate CLV in high risks markets.**

Keywords-components; Customer Lifetime Value (CLV); Environmental risks; Supplier's flexibility; Customer attraction/retention cost; real options analyses

I. INTRODUCTION

CLV is an important parameter in B2B and B2C relationships. Managers could make better decisions to increase investment by assessing CLV. Inasmuch B2B relationships need investment to startup or maintain the relationship; a customer could be viewed as an investment issue: an initial investment is followed by a stream of future cash flows from this customer. Therefore, the majority of contributions that investigate CLVs are based on simple net present value (NPV) considerations. By 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[1].

Despite of NPV's broad acceptance, it is not most appropriate approach which value customers in relationships. The most important reasons for this inappropriateness are: 1) the environmental risks (such as fluctuations in demand, changing customer needs, technological change, changing prices and production costs); 2) supplier's flexibility (such as increase or decrease production in react to risks or switching to new technologies when a technology obsolete); 3) Customer attraction/retention's cost (such as marketing cost for attract a customer at first time and cost of after-sales services for costumer's retentions). Consequently, simple NPV analyses could assess CLV when the market has no environmental risks and there is no flexibility of suppliers.

The aim of this paper is to develop a CLV valuation model based on environmental risks, supplier's flexibility and customer attraction/retention's cost. First of all, buyer-seller relationships are divided in to four different types. This division is based on the degree of environmental risk's affects and supplier's flexibility and after that a new CLV evaluating model is recommended in each type. Moreover, there is a discussion at the end of paper that shows theoretical and managerial implications of this CLV evaluating model.

II. HISTORY OF CLV'S 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[2]. In1985, Jackson differentiated customers to lost-for-good and always-a-share. She proposed distinct approaches with which to assess industrial customers according to their buying behavior. Lost-for-good customers buying with high switching costs therefore they are reluctant to switch suppliers. Although these customers are committed to only one vendor, 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. It means that the always-a-share customers can apportion their purchases among suppliers while maintaining low costs. Jackson suggested calculating different versions of NPVs to explore the value of the two customer groups [3]. Afterward, Dwyer extended Jackson's analysis by refining and applying it to a direct marketing context [4]

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 [5]. 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 and they demonstrated their models with numerical examples [6]. In 2001, Jacobs, Johnston and Kotchetova used a NPV based model in B2B context for calculating CLV[7]. Customer value also was evaluated in B2C context by Reinartz and Kumar in 2003. In order to calculate CLV, they used the present values of the customers' estimated contribution margins[8]. Adams demonstrated a new model for CLV by using real options to assess customer equity. In this model Adams showed how the real options approach could be applied to assess an insurance customer firms' equity[9].

As a conclusion, most of these models calculate CLV by (simple) NPV and there is neither attention to environmental risks nor attention to supplier's flexibility. If customers' cash flows remain 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. This research method uses real option analysis to evaluate customer in high risk markets with supplier's flexibility, and costumer attraction/retention's cost from customer cash flows is subtracted to calculate accurate CLV.

III. DIVISION OF RELATIONSHIPS IN REAL MARKETS

The buyer-seller relationship in real markets could be divided to four types, by degree of environmental risks and flexibility of suppliers. Table 1 shows an appropriate CLV's model in each relationship type.

A. When environmental risk is low, customer's demand is constant and usually suppliers are not flexible. In this case, using of NPV is very appropriate for calculating CLV.
B. When environmental risk is low, customer's demand is constant but in some case suppliers may change their investments to be flexible with new technology or new customers. In this case, using NPV is very appropriate too because in spite of supplier's flexibility, customer's demand is constant.
C. In this case, environmental risks affect customer's demand and suppliers cannot change their investment for reaction. To include environmental risk in the valuation of customers in relationships, simple NPV analysis has to be extended by computing expected CLVs. Future cash flows from the customer are changes to high or low with different probability. Monte Carlo simulations can be used to assess CLVs' probability distributions[10]. Sensitivity analyses can further complement the understanding of the variation of the underlying parameters and their impact on CLVs [10].
D. In the last case, it is assumed that high affect of environmental risks and high flexibility of suppliers for reaction. Real option analyses are appropriate for calculating CLV in this case. In financial economics, real option analyses has increasingly attracted attention as a means for assessing the value of risky investment projects[11]. Because of the supplier's flexibility, in this case, an important factor is decision of invest or divest to increased customer's demands. In this paper this decision is modeled by sensitivity analyses.

Table1 CLV's MODELS IN DIFFERENT TYPE OF RELATIONSHIPS

		Supplier's flexibility	
		low	High
Environmental risks	Low	(1) Simple NPV analysis	(2) Simple NPV analysis
	high	(3) Extended NPV, Monte Carlo simulations, sensitivity analyses	(4) Real options analyses, sensitivity analyses

IV. OUR CLV'S MODEL IN EACH RELATIONSHIP

Customer cash flow and probability of increasing and decreasing future demands in each model is considered. Another important parameter in calculating CLV from customer's side[1] is costumer attraction/retention's cost. In each model, these costs are subtracted from customer cash flow to calculate exact value of customer life.

A. Case1: Low environmental risk, Low supplier's flexibility

Markets conditions are stable; when demand in customer markets, production costs and prices are constant. In this case, estimating future cash flows of customer is very easy. These conditions often overcome in mature markets in which a few competitors compete for market share. In these markets demand can be well forecasted and is stable due to businesses and consumers' constant need. Then with a few input parameters the future cost and price can be estimated.

In other side, these markets do not need any change in supplier's productions or investments. Then most of suppliers in this case are not flexible so (simple) NPV can evaluate CLV, because the future of customer cash flows can be estimated very accurate[10]. The last thing which is important in this equation is costumer's attraction/retention cost. As it shows in equation (1) this costs must subtract from the future costumer cash flows to determine accurate CLV.

$$\text{CLV (Case 1)} = \sum_{t=0}^{n} \left(\frac{\text{m.q}}{(1+\text{i})^{\text{t}}} - \text{A}_{\text{t}}\right) \qquad (1)$$

[1] Each relationship has two sides, customer's side and supplier's side

Equation (1) can calculate CLV (case1) in n future periods of time. In this equation m is the supplier's margin per unit realized with a specific customer, i.e. price per unit minus costs per unit. And q is the volume sold to the customer. If there is low risk, q is stable in each period of t. It is difficult to determine an appropriate discount rate at which to discount future cash flows ($m.q$). Customarily, companies expect rate of return for an equivalent investment in the capital market[10]. For simplicity, it is assumed that future margins will be discounted at the risk-free interest rate i. Finally, A_1 is the costumer attraction cost that can be calculated by dividing cost of marketing to number of customers. Further, A_t is customer' retention cost for $t>1$, it can be calculated by dividing cost of after-sales service to number of returned customers.

B. Case2: Low environmental risk, high supplier's flexibility

When there is no environmental risk the customer's demand is constant and market is stable, however, there are some suppliers that are flexible for reacting to potential market changes. For example, a supplier may be able to adapt production by investing in new production capacities or divesting existing capacities. These flexibilities do not affect future cash flows of old customers, therefore the use of the CLV's model described in Case 1 is suggested.

C. Case3: high environmental risk, low supplier's flexibility

Case 3 shows a relationship with high affect of environmental risk. Risk can appear as operational risk due to the nature of a firm's business activities, country risks, risks from competitors' actions, technological risks and demand-side risks. All types of risks result in fluctuations in demand, price, costs and thus have an immediate impact on the customer's cash flows [12].

On the other hand, suppliers are not flexible to react to changes in case 3. So a supplier with limited investment and limited capacity of product is assumed. Therefore all increases in customer's demands cannot respond by supplier's product.

Equation (2) shows CLV in case 3. All parameters were described in case 1, except q_t. In this equation, qt is the volume sold to the customer in each period of t. If customer's demand is uncertain, the q can go either up or down in future periods. In equation (2), q_t is assumed as a stochastic process in which the initial demand volume is q_0. A binomial approach have been chosen for q_t as it is easy to use and can span a large range of applications (binomial approach in used in many papers for estimating future demands of a customer [10][13]).

$$CLV\ (Case3) = \sum_{t=0}^{n}\left(\frac{m.q_t}{(1+i)^t} - A_t\right) \qquad (2)$$

For calculating q_t in each period, parameters of binomial stochastic process must be determined. We set letter p for the probability of different next states. This probability p can be mathematically derived from the stochastic processes. It is clear that if p is probability of increase in next period then *(1-p)* is probability of decrease in next period. And we set $u>1$ the increase factor of demand in next period, and $d<1$ the decrease factor of demand in next period. For example in period t_1, the customer's demand (q_1) is equal to $p.u.q_0+(1-p).d.q_0$, and so on. Equation (3) show CLV (case3) in periods t_0 and t_1 .

$$CLV\ (Case3) = m.q_0 - A_0 + \frac{(p.u+(1-p).d).m.q_0}{(1+i)} - A_1 \qquad (3)$$

To include further periods, additional terms have to be added. For projecting CLV in three periods of $t=0,1,2$ the following term equation (4) needs to be added to equation(3).

$$t_2 : \frac{(\mathrm{p.u}+(1-\mathrm{p}).\mathrm{d})^2.\mathrm{m.q_0}}{(1+\mathrm{i})^2} - A_2 \qquad (4)$$

Furthermore, for CLV in periods of t=0,1,2,3 , the following term equation (5) has to be added to above equation:

$$\mathrm{t}_3 : \frac{(\mathrm{p.u}+(1-\mathrm{p}).\mathrm{d})^3.\mathrm{m.q_0}}{(1+\mathrm{i})^3} - \mathrm{A}_3 \qquad (5)$$

As it can seen in above equation, different future potential demands are calculated in this model (e.g., $u_3.q_0$), multiplied with the supplier's margin per unit m, weighed with probabilities 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 Case1would overcome. Similarly, if p converged towards 1, the future upward state would become certain and Case 1 would again overcome.

On the other hand suppliers are inflexible in Case3 then they cannot add further investments to the relationships. It is due to a lack of financial resources and they cannot respond to future increase demands more than their capacity. For example, imagine a supplier with $q_0=50$, if the supplier's capacity at last be 100 units. Subsequently, for calculating CLV in the terms that qt would be more than 100, it must be discounted to 100. In this way, customer would be evaluated with environmental risk in demand and without supplier's flexibility.

D. Case4: high environmental risk, high supplier's flexibility

In case 4, effect of environmental risk is very high and supplier is flexible too. Therefore, Case 4 is an extension of Case 3 since it includes the supplier's real options (or flexibility) in addition to environmental risks. A real option is the right, but not the obligation, to buy or sell a real asset at a predetermined cost on or before some fixed date. Thus, real options allow investors to add value, to amplify good fortune or to mitigate loss [5]. Flexible suppliers can expand or reduce a relationship; even they can terminate relationships or switch their partners. These flexibilities are results of the supplier's investment and their human resources. For example, imagine a supplier's capacity is 100 units in each period. After a few periods, if customer's demand increases more than 100 units, the supplier can invest more in the relationship to expand it, and produces more than 100 units in each period. Initially, it seems good, but there are other parameters in a new investment that supplier must consider those and expanding the relationship needs capital expenditure. This Capital expenditure must be subtracted from profit, t_0 determine which of them is more profitable expanding the relationship or producing with limited capacity. This parameter is illustrated in equation (6) with use of max function.

$$CLV\ (Case4) = \sum_{t=0}^{n} \frac{\max\,(m.q_t(S) - S\,, m.q_t)}{(1+i)^t} - A_t \quad (6)$$

All parameters in equation (6) are like equation (3) in case 3, except $q_t(s)$ and s. In this case, $q_t(s)$ is increased customer's demand after expanding the relationship and s is the capital expenditure for this expansion. s must be subtracted from increased future cash flow $[m.q_t(s)]$ to determine the exact customer's future cash flow, in each period. Finally, compare two situations, invest more resources to increased customer's demand or divest increased customer's demand. Max function in equation (6) compares these situations and chooses the best one.

To sum up, if future cash flows from customers are volatile and if the supplier in a relationship is flexible in reacting to it, real options analysis is the more appropriate approach to assess the value of customers in relationships rather than associating a single option with a customer in a relationship. Besides, there is a possibility to link a sequence of options with a customer [10] and the relationship can be viewed as a sequence of real options [14].

V. CONCLUSION AND FUTURE WORK

This paper describes a CLV evaluating model for each type of business relationships. This model assesses customers in high risk markets with or without supplier's flexibility. Real options analyses help to determine exact future cash flow of a customer and calculate more accurate CLV than NPV-based models. One of the most important consequences of real options analyses in the developed model is better decision making in relationship management. These analyses help companies to manage their investment's resources in increasing or decreasing situations of customer's demand. It means that the developed CLV model not only highlights profitable customers (marketing strategy) but also hint better management decision to invest or divest in increasing or decreasing demand situations. If customer relationship management (CRM) systems use this model and monitor customers in all periods, they could offer better decision in relationship management strategy and investment strategy.

Developed model evaluates customer in every high risk or low risk 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 some input parameters in the model, especially in case 4 that user must estimated them. Various estimated data are necessary to assess the accurate CLV. These parameters are investment expenditure (s), probability of increase or decrease customer's demands (p), and the customer's attraction/retention costs (A_t). In the case of financial options, these parameters could be determined from historical market data [14]. 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 [16]. According to this matter, finding a way to determine accurate input parameters to simplify use of this CLV model could be future works.

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