Customer Lifetime Value (CLV)

A Methodology for Quantifying and Managing Future Cash Flows

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Should you buy my magic coin?

You get to flip this coin once per month, starting next month, for as long as you have it.

Each flip, there is a 95% chance that it will come up “heads”…and each month it comes up heads, you get $5.

How much would you pay? $50? $500? $5000?

(as with all magic, there’s a catch)

The first time it comes up “tails”, it disappears.
Up-front expense to buy the coin.

The “expected life” of the magic coin = 19 months

…yielding an expected pay-out of $95 ($5 x 19)

…before it disappears.

(as with all magic…in economics…there’s a catch)

Using a 10% annual rate of return, the present value of the coin’s expected pay-out is about $82.
Fact-based financial decisions...

Don’t pay more than $82 for this particular “95% heads, $5 monthly pay-out” coin.

How much would a “95% heads, $10 monthly pay-out” coin be worth? Answer --- $164

How much would a “98% heads, $10 monthly pay-out” coin be worth? Answer --- $350

What if increasing the monthly pay-out decreases the probability of heads?

How much would it cost me to alter the probability of heads from 98% to 99%?

How much would that change the lifetime value?
Overview – the next 60+ minutes

Part 1 --- The Overview

Part 2 --- Some Details

Part 3 --- How to Use It
Customer Lifetime Value...

Lifetime Customer Value... LifeTime Value...

Customer Management Account Experience Potential Profitability Attrition

Activity Life Cycle Revenue

Strategic Costs Behavior Future

Optimization Value Life Time

Shareholder Long Term Margin

Acquisition Retention Churn
Customer Lifetime Value – who cares?

Wikipedia:

...customer lifetime value (CLV), lifetime customer value (LCV), or lifetime value (LTV) is the present value of the future cash flows attributed to the customer relationship. (not exactly...omits historical value)

Warren Buffett (clearly one of the world’s most successful investors) says he values a business by discounting net annual future cash flows the business is expected to generate at an appropriate discount rate to get the present value of the business.

Corporate Valuation Concepts (the Ogdenized summary):

• Sum CLV across all customers, and you get the “Customer Equity”.
• Customer Equity is the primary source of cash flow, for most businesses.

• Conclusion: CLV↑ = total value of the business↑
CLV 101: margin + retention = value

The essence of CLV \(\rightarrow\) get higher margins, loooong into the future.

- **High Retention Likelihood**: Improve
- **Low Retention Likelihood**: Learn-from & acquire more

### Diagram

- **High Margin $**
  - **High CLV**: Improve
  - **Low CLV**: Eliminate as a last resort
- **Low Margin $**
  - **Med CLV**: Improve
  - **Low CLV**: Improve
CLV – mechanism to measure retention ROI

Churn / Retention is a primary component of future value.

How valuable is it to reduce churn? Consider...

with a monthly margin of $30,
a monthly churn probability of 5%,
and a discount rate of 10% (for present-value calculations)...

Customer’s Future Value = $491

Now, if we decrease monthly churn probability to 4%...

Customer’s Future Value = $600

For 10M customers, that is worth over $1 billion...
incremental net present value of future cash flow!
CLV – simple, eh?

- CLV is a sum of returns, over the “life” of a customer.
- Sum margins (profits) from a given customer, from the time you acquire that customer until they are no longer your customer.

Example: $-100 + 75 + 80 + \ldots + 63 = \text{CLV}$
CLV – so what’s the big deal?

Measuring margins at the customer level... not so easy.

*Predicting the future*... not so easy.

What is the value of each customer today?
What is the expected amount of future money?
What can I do to increase future money?
CLV – value statements

- FROM → status quo.
  - TO → best practice…via CLV methodology.

- Aligning acquisition costs with revenue and/or volume.
  - Align acquisition costs with long-term value generation.

- Focusing retention on high-risk and/or high-revenue customers.
  - Focus retention on highest potential CLV increase.

- Responding one-by-one to customer complaints.
  - Generate ROI via customer experience improvements.

- Tracking monthly margin & churn, and reactively analyzing shifts.
  - Proactively forecast drivers of margin & churn.

- Up/cross-sell based simply on eligibility, or probability to respond.
  - Up/cross-sell based on potential incremental CLV.
CLV – step by step

- Customer lifecycles, modeling, mechanics
- Mathematics, econometrics, financial acumen
- Value creation, relationship mgmt, improving & optimizing
CLV – the 3-step program

1. What **formula** to use?
   - **Commonplace** – fixed margin multiplied by expected life
   - **Best Practice** – project retention time series, project margin time series, sum net present value, with a terminal value into perpetuity

2. How best to **model retention**?
   - **Commonplace** – single predicted “churn” probability, or survival analysis for expected life
   - **Best Practice** – logistic regression, with projection of time-variant covariates (trending key predictors to project retention time series)

3. How best to **project future margins**?
   - **Commonplace** – single margin, average of recent (e.g. 3) months
   - **Best Practice** – 12-month rolling customer average, adjusted for macro revenue & cost trends, with special handling of early-life account adjustments & customers with little account history
CLV – how good is good-enough?

Business Objective (examples)

- simple rank ordering
- call center routing
- strategic investment planning
- customer segmentation
- up/cross-sell planning/prioritizing
- retention investments
- process improvement (CRM)
- acquisition/channel strategy
- business case support

Sophistication Necessary (H, M, L)

<table>
<thead>
<tr>
<th>Formula</th>
<th>Retention</th>
<th>Margins</th>
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Level of effort increasing
CLV – step 1…what formula to use?

What CLV formula to use?

Commonplace – fixed margin multiplied by expected life

Best Practice – project retention time series, project margin time series, sum net present value, with a terminal value into perpetuity

Question #1:

Do you need only Future Value? Or Historic Value as well?

Answer --- depends on how you plan to use CLV.

Prioritizing retention → Future Value only

Acquisition strategy → Historic + Future Value
CLV = historic + future

Let’s tackle the “easy” part first…

Historic Value:

- acquisition + revenue − costs
- Acquisition costs are often averages, based on acquisition channel.
- Revenue is often easily tracked by customer.
- Costs:
  - Directly attributable only? Or including allocated costs?
  - Fully allocated overhead?
  - Tie to income statement?
  - Provided by (or blessed by) Finance department?
  - Include one-time “catastrophic” blips? E.g. product recall.

- Historic Value requires a thorough understanding of profitability at the individual customer level. This can be tricky.
CLV = historic + future

Now for the “fun” part…

Future Value:

• revenue – costs (in the future, discounted to present value).
• May want to project revenue and cost separately, or just net margin.
• Customer revenue may be a semi-fixed recurring amount (e.g. telco) or may be sporadic (e.g. retail).
• Revenue may include projected up/cross-sell efforts.
• Costs may simply be a percent-of-revenue, or may be variable forecasts.
• Future costs may exclude certain historic costs (e.g. activation fees).
• Future revenue & cost projections should incorporate macro trends.

The “lifetime” misnomer… CLV

\[
\text{CLV} = \text{CHV} + \text{CFV}
\]

\[
\text{CLV}_{\text{Lifetime}} = \text{CHV}_{\text{Historic}} + \text{CFV}_{\text{Future}}
\]
CFV – *future* value mathematics
CFV – the fundamental form

- Future Value for “customer $j$”:

$$CFV_j = \sum_{t=1}^{\infty} (-c_j) \frac{\left( R_{jt} - C_{jt} \right)}{(1+d)^t}$$

Primary issues:
- How to implement an infinite summation?
- This text-book form utilizes a constant churn rate.
CFV – perhaps the most common form

- **Future Value for “customer j”**: 

  \[
  CFV_j = \sum_{t=1}^{L} \frac{(R_{jt} - C_{jt})}{(1+d)^t}
  \]

  - **Expected remaining “life”**
  - **Margin**
  - **Present value math**

**Primary issues:**

- Estimating \( L \) (remaining customer life) is often done with traditional survival analysis, which has inherent limitations in modeling customer retention.

- The concept of “remaining customer life” may not even be appropriate (e.g. retail, gaming).
CFV – a highly simplified form

- A simplified formula, assuming both the margin and the churn rate are constants over time:

\[ CFV_j = m_j \times \left( 1 - \frac{c_j}{d + c_j} \right) \]

An even more simplified form is to merely multiply margin times expected life, without use of discounting-to-present-value.

Easy to calculate! However...

Primary issue:

- Assumes a constant churn rate, and a constant margin.
CFV – a recommended form

- Implement a formula which:
  - Eliminates the infinite summation.
  - Allows for non-constant margin and non-constant “churn”.
  - Captures value into perpetuity.
  - Incorporates future margin trends.

The following are formula developed within SAS, specifically designed to calculate accurate lifetime value, and to overcome the weaknesses inherent in the most common approaches used today.
CFV – a recommended (patent-pending) methodology

\[
CFV_j = \sum_{t=1}^{k} m_{jt} \times \frac{r_{jt}}{(1 + d)^t} + v_{k+1}
\]

- \( CFV_j \) = Future Value of customer \( j \) (a net present value)
- \( t, s \) = time period (i.e. 1 for month one, 2 for month two, etc…)
- \( k \) = “projected period”…details not covered here
- \( r_{jt} \) = probability for customer \( j \) to generate revenue in time \( t \)
  \[
r_{jt} = \prod_{s=1}^{t} (1 - c_{js}) = (1 - c_{j1})(1 - c_{j2})\ldots(1 - c_{jt})
\]
- \( c_{js} \) = probability for customer \( j \) to churn in time period \( s \)
- \( m_{jt} \) = margin from customer \( j \) in time period \( t \)
- \( d \) = monthly discount rate, or risk adjusted cost of capital
- \( v_{k+1} \) = residual value from the \( k+1 \)th month into perpetuity
Future Value Math – you love math, right?

\[
CFV_{k+1} = \sum_{t=1}^{\infty} \left( -c \right) \mathbf{m}_{k+1}^{t} \frac{(R_{jt} - C_{jt})}{(1 + d)^{t}}
\]

\[
CFV_{j} = m_{j} \left[ \frac{d + c}{1 - c_{j}^{k+1}} \right] \left[ \frac{1}{d \mathbf{0}_{k+1}} \right] \ast \left[ \frac{1}{1 - c_{j}^{k+1}} \right] \left[ \frac{d (R_{jt} - C_{jt})}{(1 + d)^{t}} \right]
\]

\[
CFV_{j} = \sum_{j=1}^{n} m_{jt} \ast \frac{r_{jt}}{1 - c_{j}^{k+1}} + V_{k+1}
\]

\[
r_{jt} = \prod_{s=1}^{s} (1 - c_{js}) \prod_{t=1}^{t} (1 - c_{jt}) \prod_{j=1}^{n} (1 + d_{jt}).(1 - c_{jt})
\]
CLV – step 2…how best to model retention?

How best to model retention?

**Commonplace** – single predicted “churn” probability, or survival analysis for expected life

**Best Practice** – logistic regression, with projection of time-variant covariates (trending key predictors to project retention time series)

**Typical Approaches:**

- Logistic Regression and the single-value churn prediction per customer.
- Standard Survival Analysis and the finite survival projection, and/or the expected remaining customer life.

**Recommended Approach:**

- Generate “survival curve”, and subsequent retention probabilities, based on more than just time changing in the future.
Retention – the pitfall of single-value prediction

Prediction for tomorrow

Such a “peak” is a real-life worst-case scenario, especially when there are service contracts in place.
Retention – the pitfall of finite survival projections

A common application of survival modeling is to calculate the remaining expected life over a fixed number of months.

Projected "life" remaining within the next 24 months

"Life" remaining beyond 24 months
Retention – the pitfall of time-only projections

- Survival Modeling --- typically assumes *only tenure* changes in the future.
- Suppose a **key driver** of retention also changes in the future.
- If you observe key drivers **trending consistently and significantly up/down**, this should influence your retention prediction.

![Predicted Churn Probability](chart.png)
Retention Modeling – what to do

A. Probability to churn…or to *not* generate revenue

\[ \text{churn} = f (\text{demographics, experience, behavior, competition, tenure}) \]

*Note: model non-linear relationship between tenure and churn propensity.*

B. Project time…

as with traditional survival modeling, churn propensity changes with tenure.

\[ \text{churn}_t = f (\text{demographics, experience, behavior, competition, tenure} + t) \]

C. Project other key factors…

forecast/trend changes in key drivers, and project churn probabilities using equation from part A, projected tenure, and projected key drivers.

\[ \text{churn}_t = f (\text{demographics, experience}_t, \text{behavior}_t, \text{competition}_t, \text{tenure} + t) \]
Retention Modeling – example

Churn is the condition of not getting revenue from the customer.

Probability of churn_t = f (age, income, geography, etc…)

**Today:**
- age = 25
- income = $100K
- geography = NYC
- product = P1
- service calls = 5
- coupons = 0
- deposits = $15K
- marketing = $1.50 per pop
- time / tenure = 12 months

**6 months from now, projected:**
- age = 26
- income = $100K
- geography = NYC
- product = P1
- service calls = 3
- coupons = 0.1
- deposits = $20K
- marketing = $2.99 per pop
- time / tenure = 18 months

In traditional survival analysis, time/tenure is the only driver that would change.
CLV – step 3…how best to project margins?

How best to **project future margins**?

- **Commonplace** – single margin, average of recent (e.g. 3) months
- **Best Practice** – 12-month rolling customer average, adjusted for macro revenue & cost trends, with special handling of early life account adjustments & customers with little account history

- True forecasting at the customer level…**not feasible**.
- Rolling averages…incorporate 12 months to correct for seasonality spikes. May want to weight recent months.
- Macro forecasting should be used to influence the trajectory.
- Macro trending can be used to project seasonality.
- Validate accuracy! Test on historical hold-out sample.
1. Customer-specific rolling 12-month average
   • With potential up/cross-sell impact?

2. Macro revenue & cost trends:
   • E.g. margins decreasing 10% annually

3. Seasonality = monthly +’s / -’s relative to annual average
CLV – recap the steps to implementation

- **Mathematics**…
  - historic + future value
  - many versions to pick from
  - recommended --- sum individual months, plus value into perpetuity

- **Retention**…
  - cautions with simple survival analysis
  - \( f(\text{demographics}, \text{experience}_t, \text{behavior}_t, \text{competition}_t, \text{tenure} + t) \)
  - more than just *time* changes in the future

- **Margin**…
  - customer-specific margin projections start with a 12-month average
  - incorporate macro trends
CLV – how to use it

- After building a retention model…

- Suppose you’ve developed customer-level margin projections…

- And selecting the right formula to put it all together.

- Now what?
CLV – leverage the mechanics

...to maximize economic returns:

- Customer Demographics
- Customer Experience
- Customer Behavior
- Customer Loyalty / Tenure

  Marketing Treatments
  up/cross-sell, retention, acquisition

  Revenue
  Account Adjustments
  Bad Debt
  Cost to Acquire
  Cost to Maintain / Serve

  CLV

  Historic Value

  Future Value

  Future Margins

  Retention Propensity

  customer segmentation
  process improvements

  pricing
  channel strategy
  cost controls
Increasing Customer Value – where? how?

- **Strategic Investment Planning**
  Scenario & Business Case analysis to prioritize strategic investments.

- **Target Marketing**
  Value-oriented campaigns…retention, up/cross-sell, acquisition.

- **Customer & Prospect Segmentation**
  Identify and target the most valuable demographics/profiles.

- **Process Improvement (Customer Relationship Management)**
  Balance customer satisfaction with ROI.

- **Enhanced Price-Demand Analysis**
  Set price to optimize CLV, not to maximize revenue.

- **Channel Strategy**
  Invest in the acquisition channels yielding the most valuable customers.

- **Cost Controls**
  Increase margins by becoming more cost-efficient; constrained by CLV.
CLV – it’s all about *improving status quo*

<table>
<thead>
<tr>
<th>All business know to:</th>
<th>But how do you:</th>
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<tbody>
<tr>
<td>Retain existing customers</td>
<td>✓ Retain the <em>right</em> customers</td>
</tr>
<tr>
<td>Acquire new customers</td>
<td>✓ Acquire <em>profitable</em> customers</td>
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<tr>
<td>Sell more stuff</td>
<td>✓ Ensure profitable campaigns</td>
</tr>
<tr>
<td>Improve the customer experience</td>
<td>✓ Strike the right balance between customer satisfaction and cost control</td>
</tr>
<tr>
<td>Strive to increase shareholder value</td>
<td>✓ Quantify economic benefits of various investments, with a consistent methodology</td>
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**Answer:** Investments / strategies / campaigns / projects / customers can be prioritized & optimized via CLV Methodology
CLV – do’s and don’ts

Maximize long term economic returns:

• View each customer as an investment…earn a return.
• Do not simply chase revenue.
• Do not try to retain everyone.
• Do not try to acquire everyone.
• Do not simply maximize customer satisfaction…nor simply increase market share.

Use CLV methodology to increase the long term economic value generated by customers.
The Challenge

- Increase effectiveness of up-sell efforts for Platinum Checking.

Status Quo

- Account Managers hand-selected accounts for up-sell efforts.

The Analytic Solution

- Predictive up-sell model to select only those accounts likely to upgrade.

The CLV Benefit

- Prioritization of eligible accounts, for a given campaign with constrained budget, based on incremental CLV.
The Challenge

- Eliminate bad-debt-risks from acquisition campaigns.

Status Quo

- Filter out previous subscribers with payment delinquency. (No filter for any new prospects.)

The Analytic Solution

- Profile likelihood of non-payment, and do not target high-risk prospects.

The CLV Benefit

- Balancing missed acquisition opportunities and acquired bad debt risks, so as to maximize long term margins.
Subscription TV

The Challenge

- Refine call center policy for providing credits...i.e. “freebies”.

Status Quo

- Any disgruntled customer could receive free service or equipment, without clear guidance/approvals.

The Analytic Solution

- Text Mining of call center notes, coupled with predictive modeling, for improved retention predictions...and a simple 5-star CLV rating system.

The CLV Benefit

- Combined future margin projections with retention likelihood to develop call center rules for how to limit credits so as to ensure ROI.
The Challenge

- Manage churn; effectively position against primary competitor; strategically invest in the customer experience.

Status Quo

⚠️ Build additional distribution centers, under the premise that shipping time is the biggest driver of customer satisfaction.

The Analytic Solution

😀 Explanatory modeling of customer churn, at a macro level, in combination with scenario analysis.

The CLV Benefit

😊 Biggest impact to long term economic value would come from eliminating certain low-value pricing plans, thereby increasing churn.
The Challenge

- Optimize marketing strategy for offering coupons to various customer segments.

Status Quo

- Offer the same coupons to limited customer segments, every month; higher coupon amounts for higher revenue customers.

The Analytic Solution

- Predictive next-best-offer model.

The CLV Benefit

- Prioritized offers based on incremental CLV; *not* based solely on expected incremental short-term revenue.
The Challenge

- Allocate $100’s millions in budgets across various functional business units (marketing, distribution, network).

Status Quo

- Use last year’s budget as a starting point, with CFO discretion.

The Analytic Solution

- Explanatory, analytic models to determine drivers of market share and churn, by time by geographic market.

The CLV Benefit

- Scenario analysis for macro investments, quantifying incremental CLV, to determine optimal allocation of budgets.
CLV – (we are approaching the last slide)

- Don’t view CLV as a static number --- actively increase CLV!
  - Perhaps low CLV is your fault! For example:
    - faulty equipment leads to high customer service calls…
    - which leads to high churn risk…
    - which results in low CLV.
  - Low CLV is an opportunity, not necessarily a state-of-being.

- CLV output is only good if you use it --- start small, start somewhere
  - Think scientifically…measure, act, test, adjust.
  - Short-term performance metrics may compromise long term stability.
  - Challenge pre-conceived notions; influence improved decision making.

- CLV is fundamental --- increase future cash flows…
  …from the bottom, up.
CLV – basic (yet profound) marketing strategy

Think *incremental* CLV.
SAS Analytics

Data / Text Mining
Forecasting
Optimization
Predictive Modeling
Statistical Analysis

Data Management
Reporting / OLAP
Data Access

Business Value

Data → Information → Knowledge → Intelligence
Customer Lifetime Value

Q&A

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