



Customer Lifetime Value (CLV)

*A Methodology for Quantifying and Managing
Future Cash Flows*

**THE
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*SAS Business Analytics Forum, Montréal
November 24, 2009*

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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**.

Gaming, Probability, Economics



Up-front expense to buy the coin.

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

...yielding an expected pay-out of \$95 ($\5×19)

...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

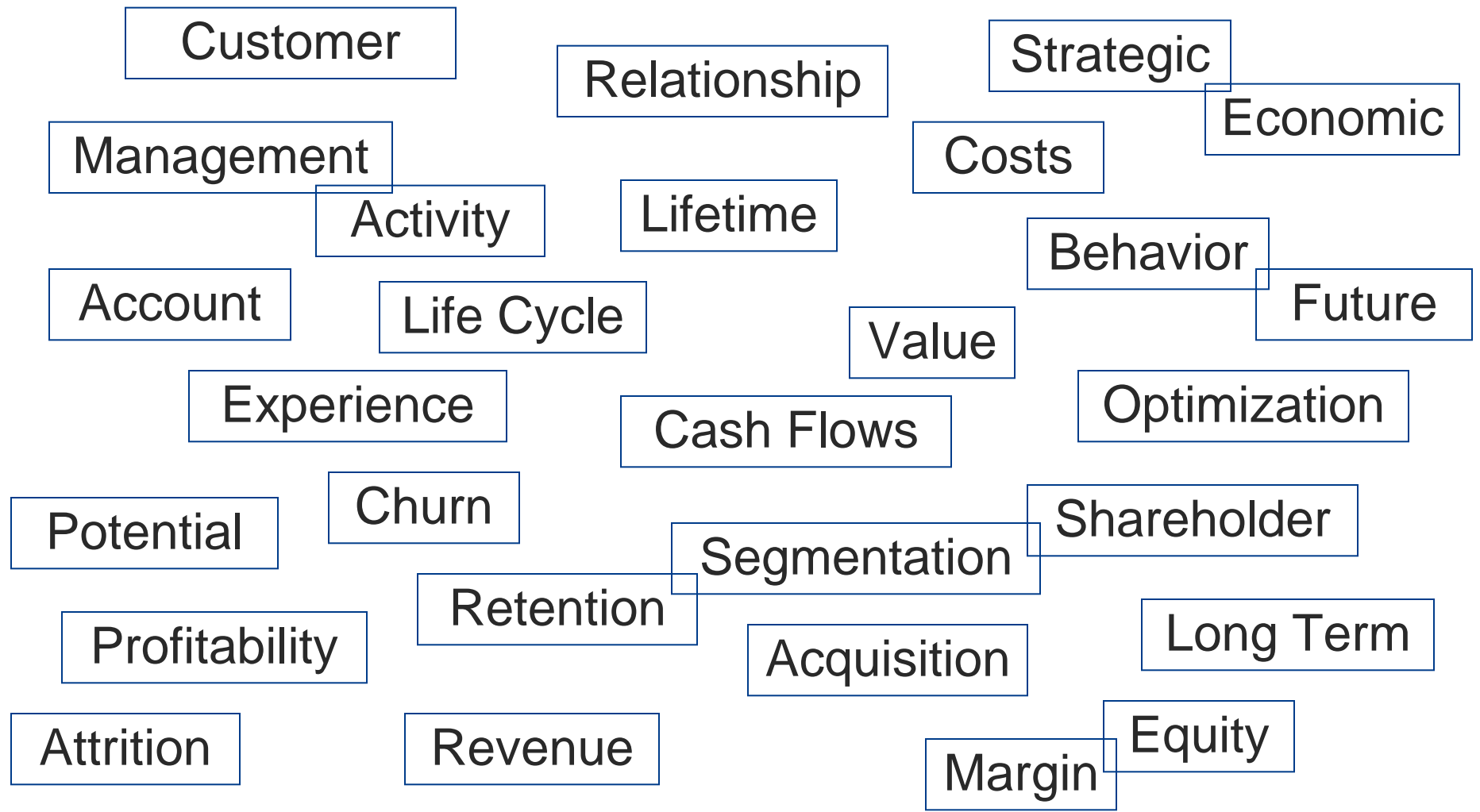
Part 1 --- The Overview

Part 2 --- Some Details

Part 3 --- How to Use It

Customer Lifetime Value...

Lifetime Customer Value... LifeTime Value...



Customer 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*)

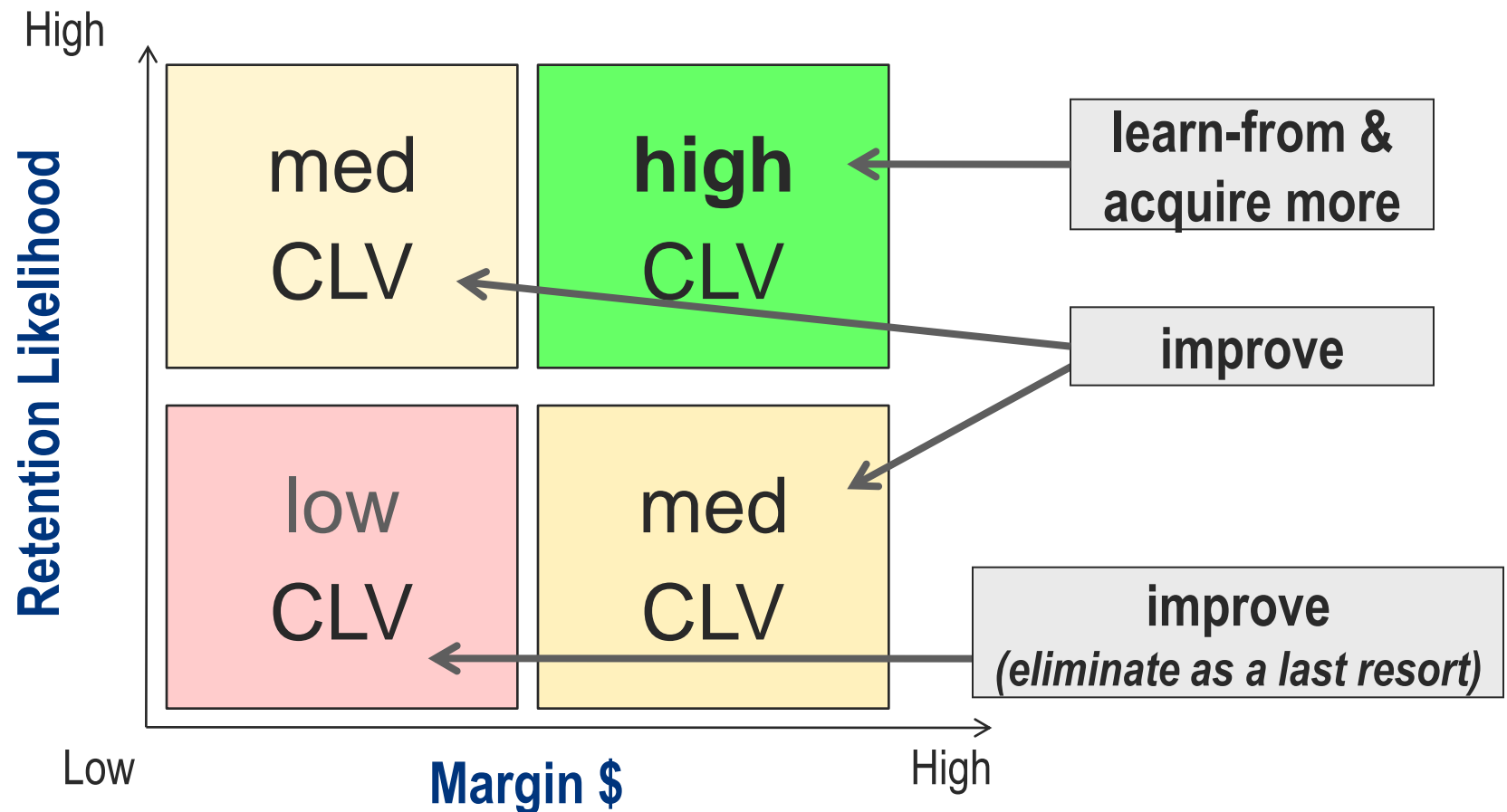
Warren Buffett (clearly one of the world's most successful investors) says he values a business by **discounting net annual future cash flows** the business is expected to generate at an appropriate discount rate to get the present value of the business.

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: $CLV \uparrow = \text{total value of the business} \uparrow$

CLV 101: margin + retention = value

The essence of CLV → get higher margins, loooong into the future.



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%...

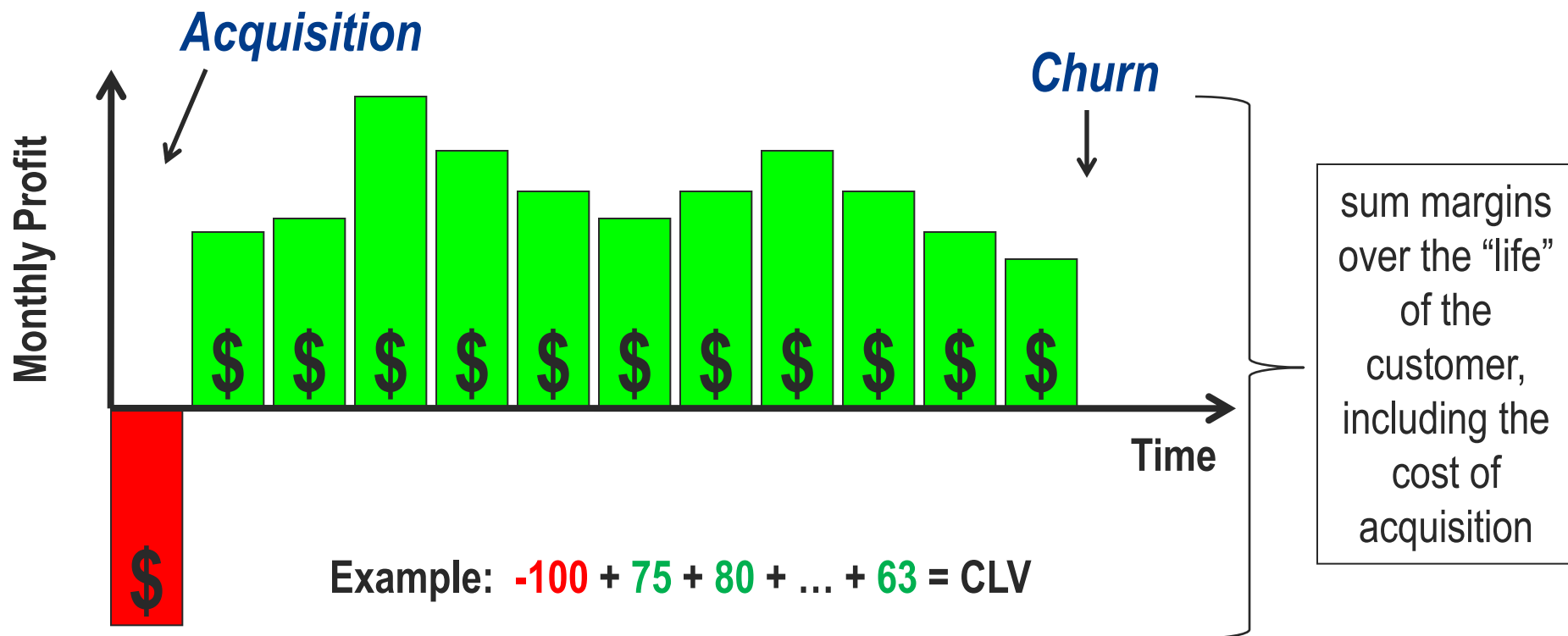
Customer's Future Value = \$600

For 10M customers, that is worth over \$1 billion...

incremental net present value of future cash flow!

CLV – simple, eh?

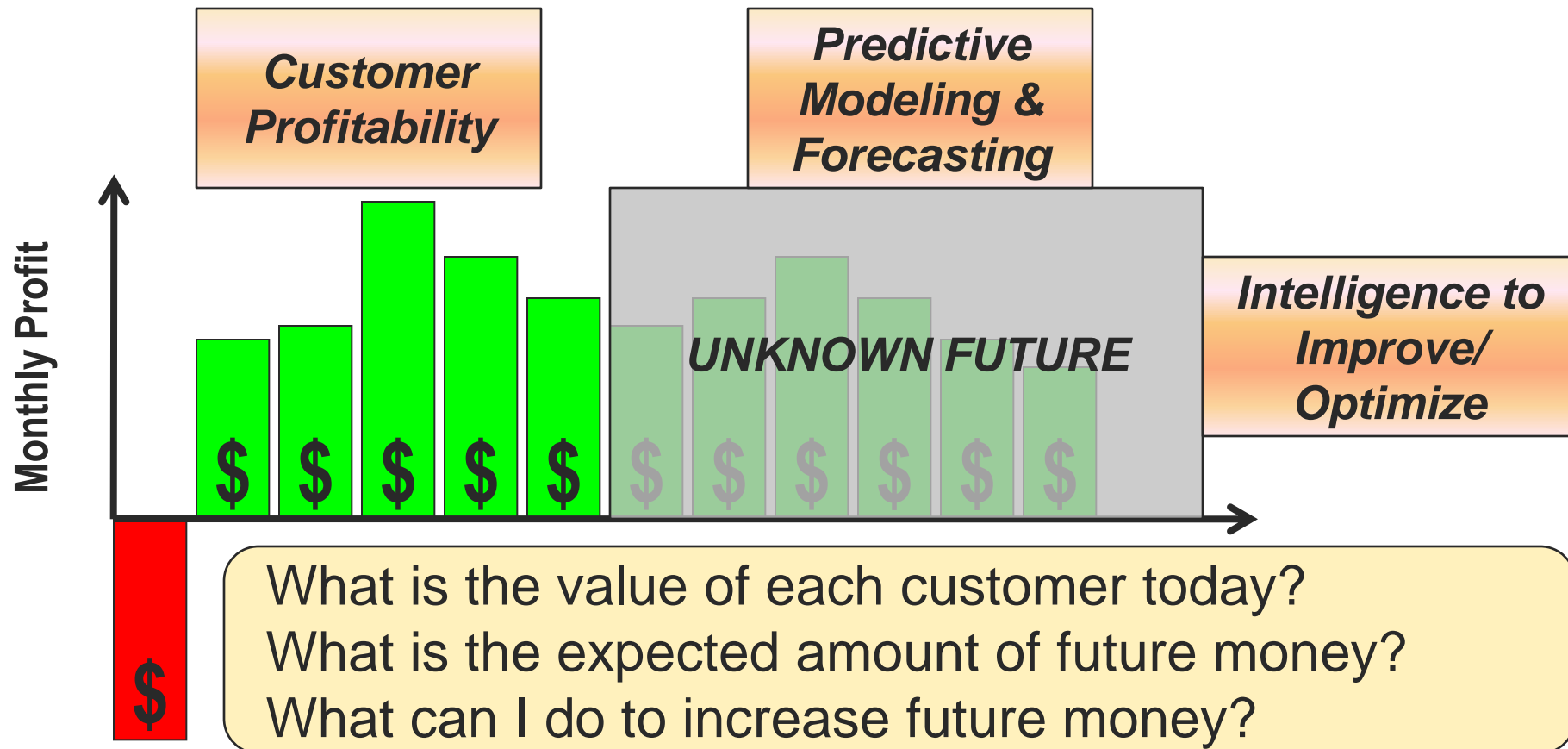
- **CLV is a sum of returns, over the “life” of a customer.**
- Sum margins (profits) from a given customer, from the time you acquire that customer until they are no longer your customer.



CLV – so what's the big deal?

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

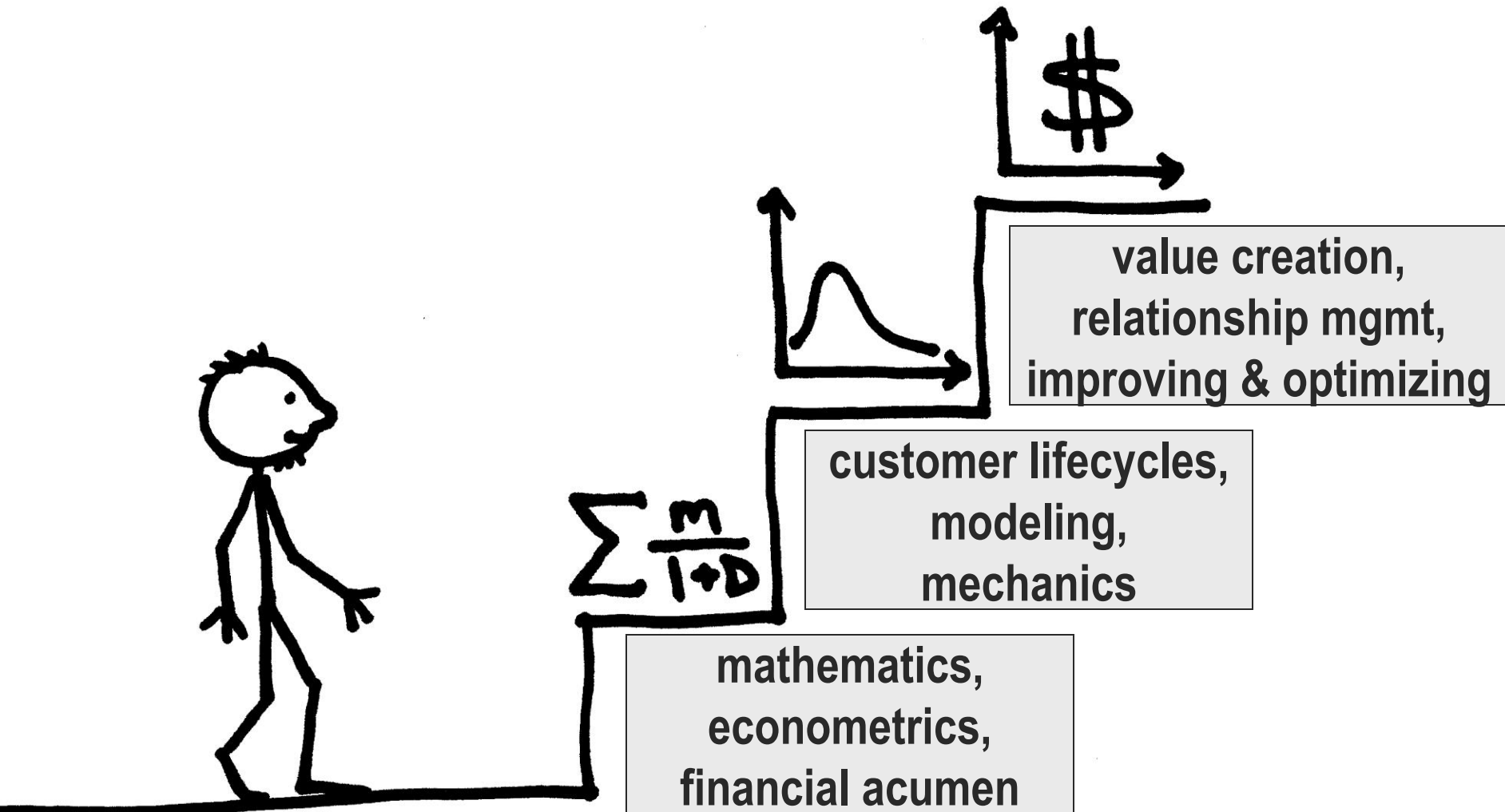
Predicting the future...not so easy.



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



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?

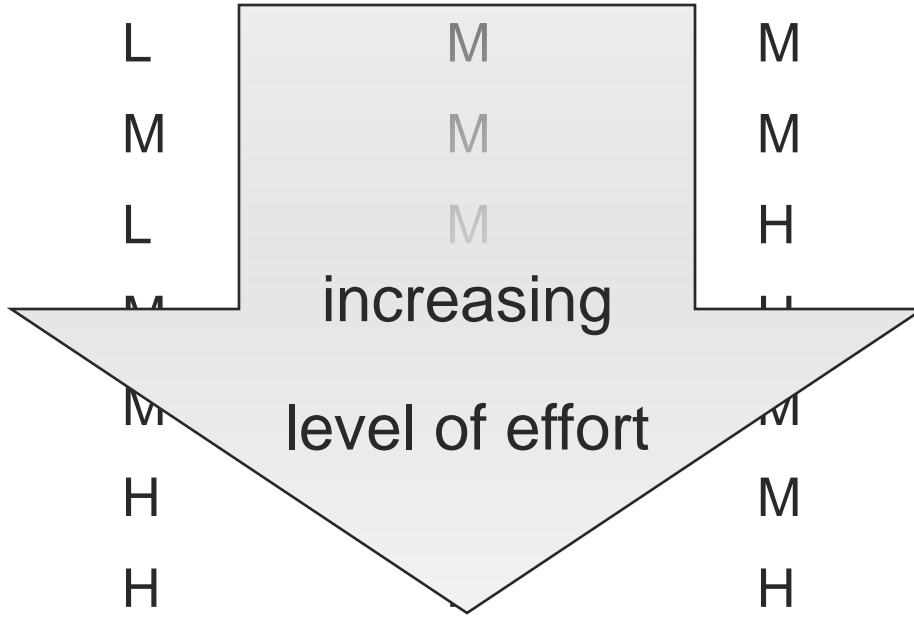
Business Objective

(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)

<i>Formula</i>	<i>Retention</i>	<i>Margins</i>
L	L	L
L	M	M
M	M	M
L	M	H
M		L
M		M
H		M
H		H
H	H	H



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...

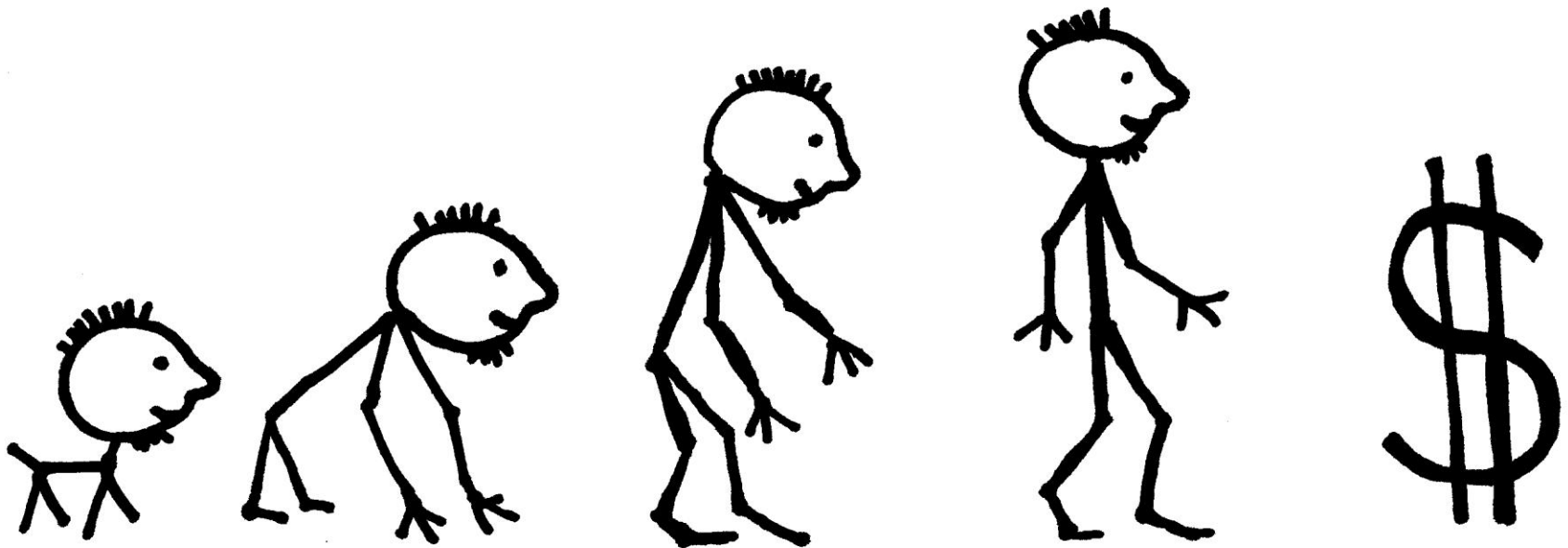
Future Value:

- 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...

$$\begin{array}{lcl} \text{CLV} & = & \text{CHv} + \text{CFv} \\ \text{Lifetime} & = & \text{Historic} + \text{Future} \end{array}$$

CFV – *future* value mathematics



CFV – the fundamental form

- Future Value for “customer j ”:

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

margin

present value math

cumulative retention probability

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 ”:

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

Annotations in the diagram:

- Box: "expected remaining 'life'" points to the upper limit L of the summation.
- Box: "margin" points to the numerator $(R_{jt} - C_{jt})$.
- Box: "present value math" points to the denominator $(1 + d)^t$.

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:

$$CFV_j = m_j * \left(\frac{1 - c_j}{d + c_j} \right)$$

The diagram shows the formula $CFV_j = m_j * \left(\frac{1 - c_j}{d + c_j} \right)$. Below the term m_j is a box labeled "margin" with an arrow pointing to m_j . Below the term c_j in the denominator is a box labeled "churn" with an arrow pointing to c_j . The term d in the denominator is circled in yellow.

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

$$CFV_j = \sum_{t=1}^k m_{jt} * \frac{r_{jt}}{(1+d)^t} + v_{k+1}$$

- 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

$$r_{jt} = \prod_{s=1}^t (1 - c_{js}) = (1 - c_{j1})(1 - c_{j2}) \dots (1 - c_{jt})$$
- 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?

$$\begin{aligned}
 CFV_j &= \sum_{t=1}^{\infty} \frac{(R_{jt} - C_{jt})}{(1+d)^t} \\
 v_{k+1} &= \left(\frac{d + c_{k+1}}{1 - \frac{c_j}{c_{k+1}}} \right) * CFV_j + \sum_{t=1}^k \frac{d(R_{jt} - C_{jt})}{(1+d)^t} \\
 CFV_j &= m_j * \left(\frac{d + c_{k+1}}{1 - \frac{c_j}{c_{k+1}}} \right) * \left(\frac{r_{jt}}{1 - c_{k+1}} \right)^k \\
 CFV_j &= \sum_{t=1}^{\infty} m_{jt} * \frac{1}{(1+d)^t} + v_{k+1} \\
 r_{jt} &= \prod_{s=1}^j (1 - c_{js}) = (1 - c_{j1})(1 - c_{j2}) \dots (1 - c_{jt})
 \end{aligned}$$

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)

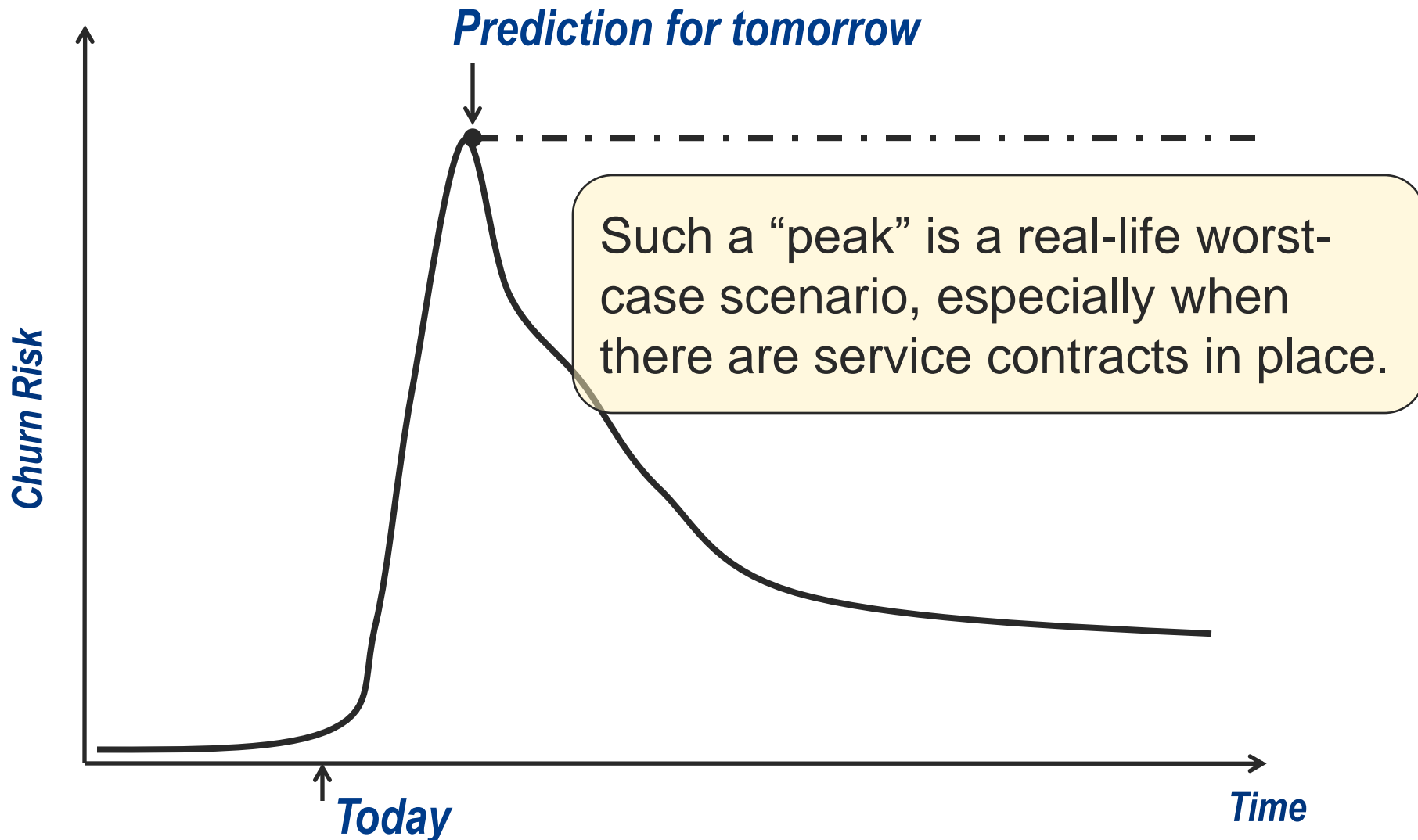
Typical Approaches:

- *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.*

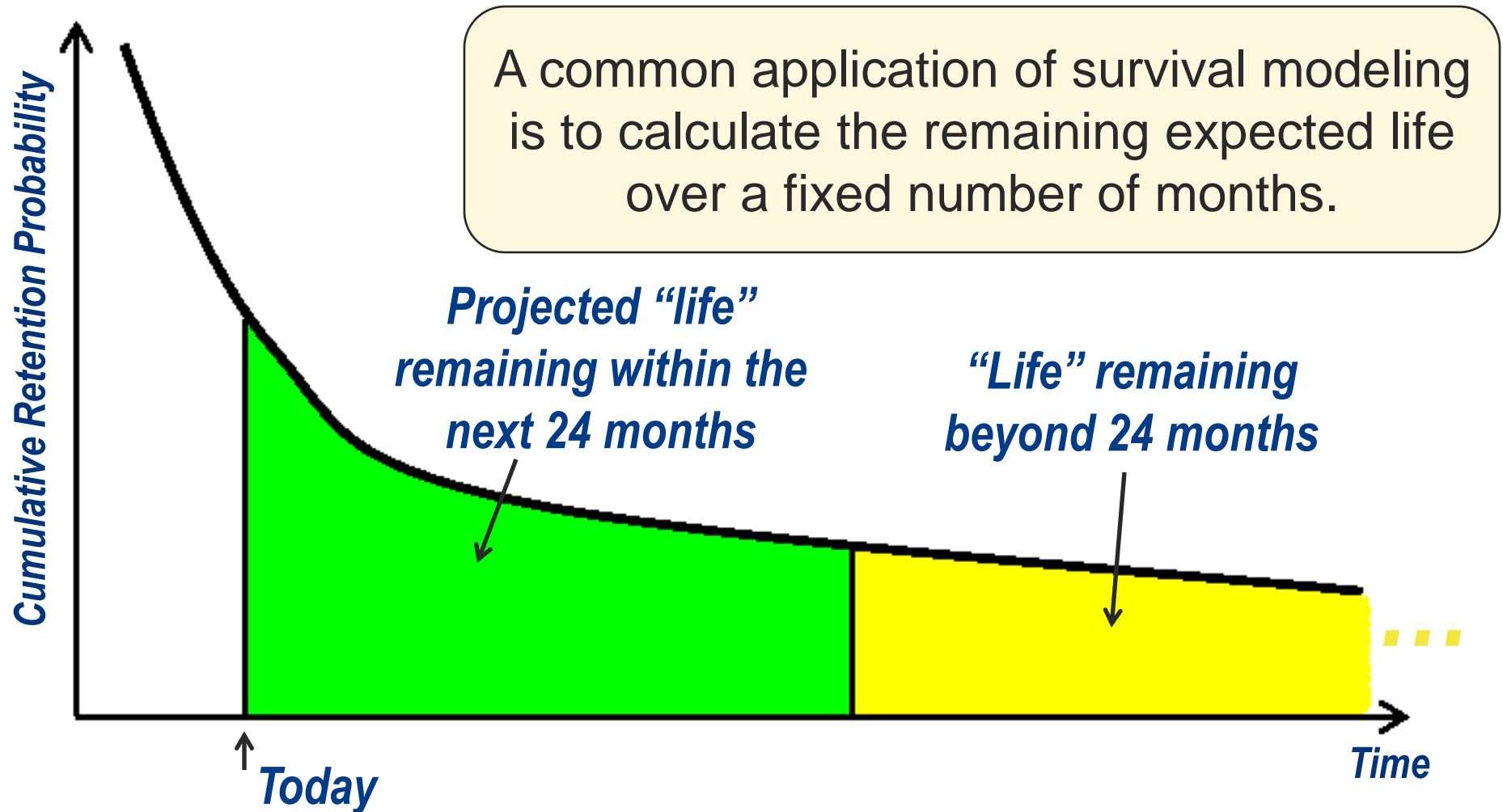
Recommended Approach:

- *Generate “survival curve”, and subsequent retention probabilities, based on **more than just time** changing in the future.*

Retention – the pitfall of single-value prediction

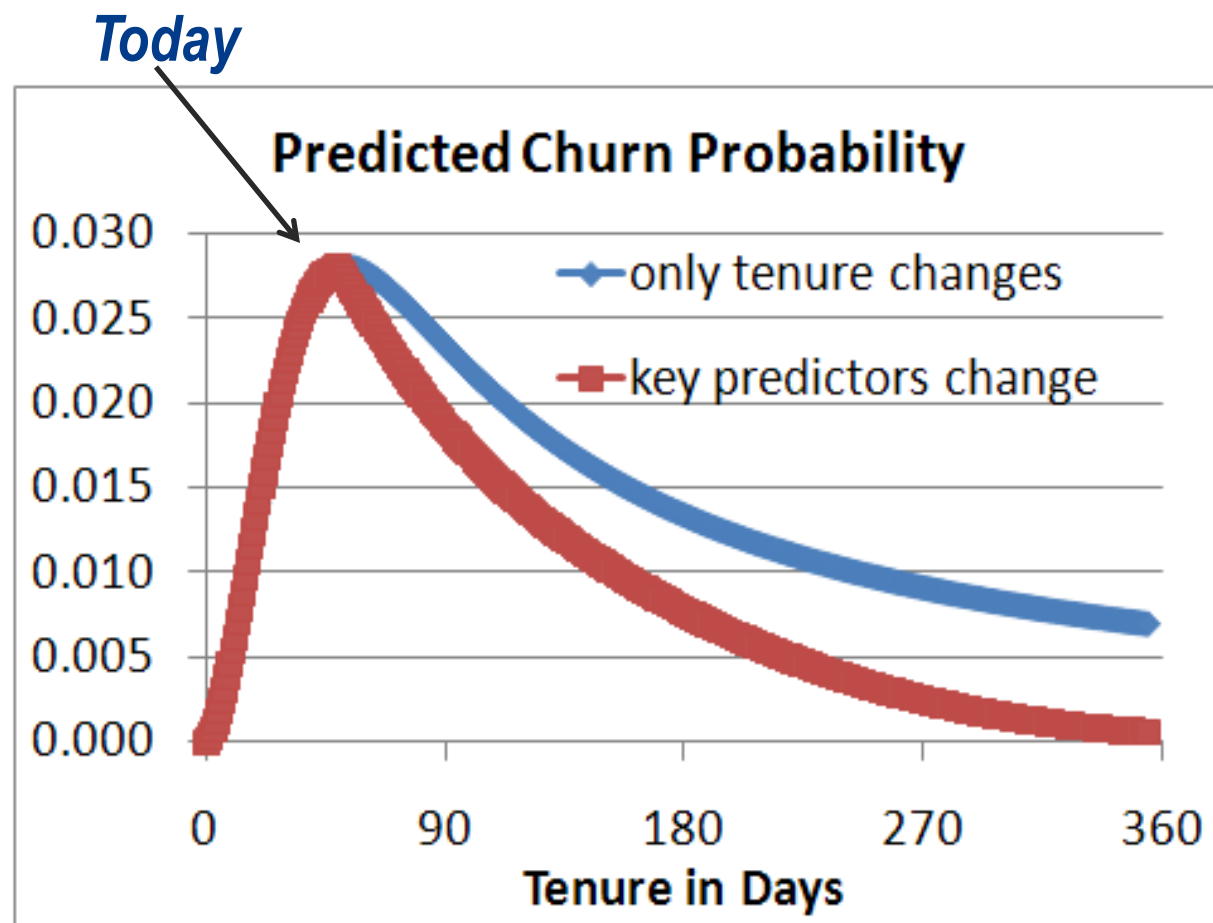


Retention – the pitfall of finite survival projections



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.



Retention Modeling – what to do

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

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

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

B. Project time...

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

$churn_t = f(\text{demographics, experience, behavior, competition, tenure} + t)$

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.

$churn_t = f(\text{demographics}_t, \text{experience}_t, \text{behavior}_t, \text{competition}_t, \text{tenure} + t)$

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

In traditional survival analysis, time/tenure is the only driver that would change.

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

CLV – step 3...how best to project margins?

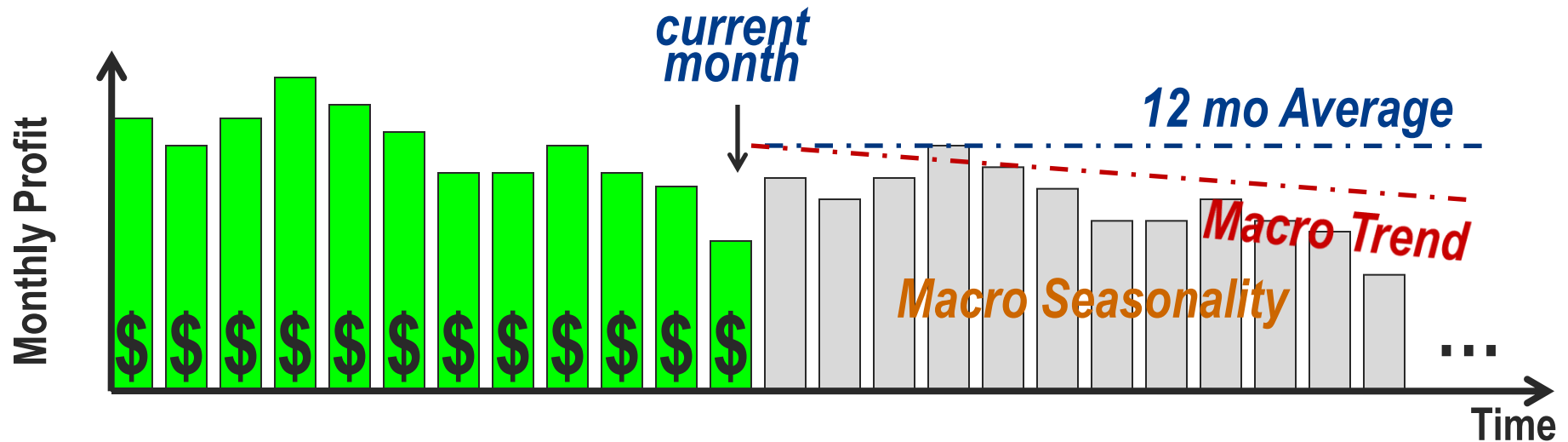
How best to **project future margins**?

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.

Margins projections – example



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

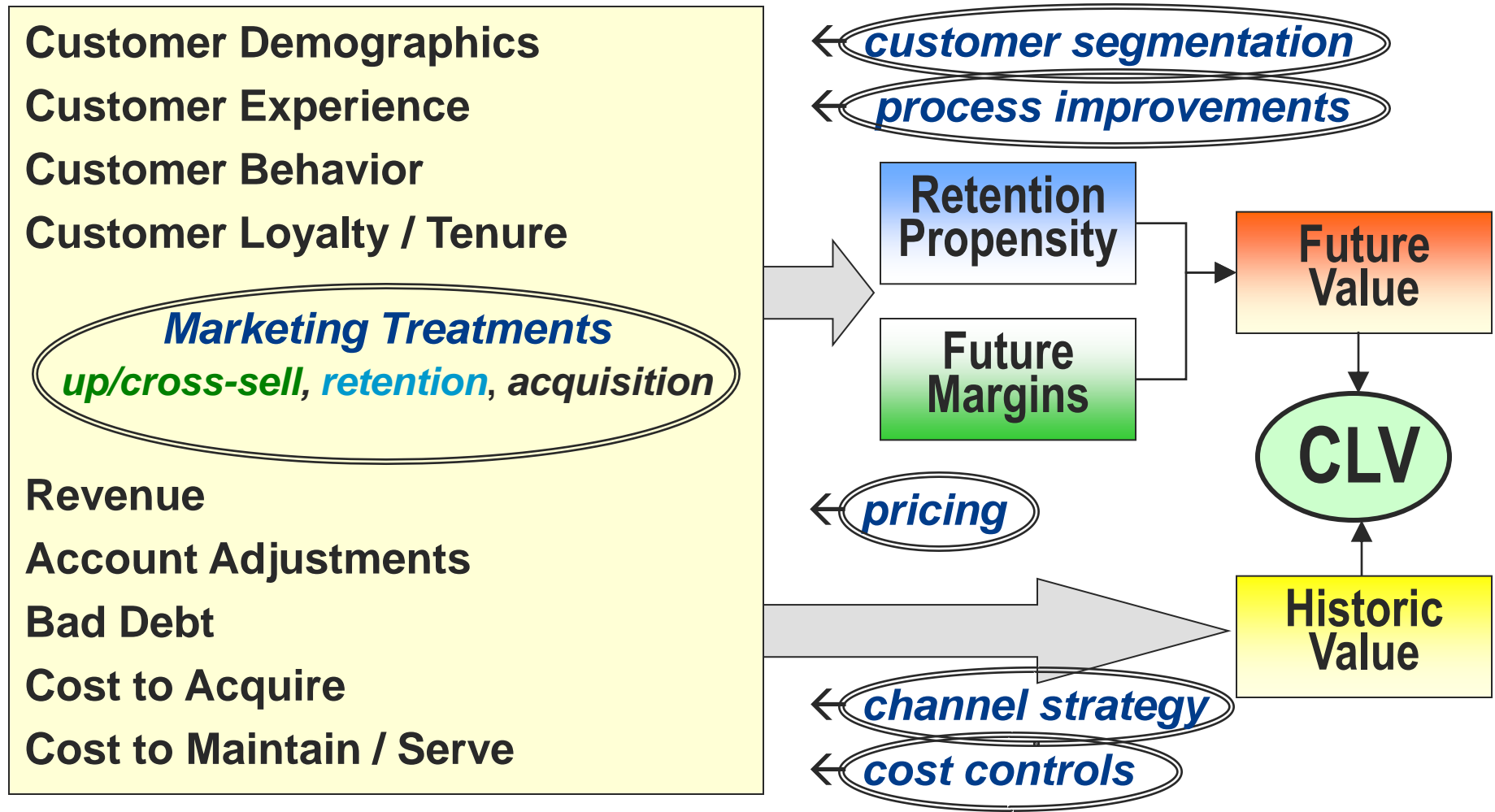
- **Mathematics...**
 - historic + future value
 - many versions to pick from
 - recommended --- sum individual months, plus value into perpetuity
- **Retention...**
 - cautions with simple survival analysis
 - $f(\text{demographics}, \text{experience}_t, \text{behavior}_t, \text{competition}_t, \text{tenure} + t)$
 - 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:



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*

All business know to:

- Retain existing customers
- Acquire new customers
- Sell more stuff
- Improve the customer experience

- Strive to increase shareholder value

But how do you:

- ✓ Retain the *right* customers
- ✓ Acquire *profitable* customers
- ✓ Ensure profitable campaigns
- ✓ Strike the right balance between customer satisfaction and cost control
- ✓ Quantify economic benefits of various investments, with a consistent methodology

Answer: Investments / strategies / campaigns / projects / customers
can be prioritized & optimized via CLV Methodology

CLV – do_s and don't_s

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.



Case Studies

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Bank



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.

Subscription Newspaper



The Challenge

- Eliminate bad-debt-risks from acquisition campaigns.

Status Quo

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

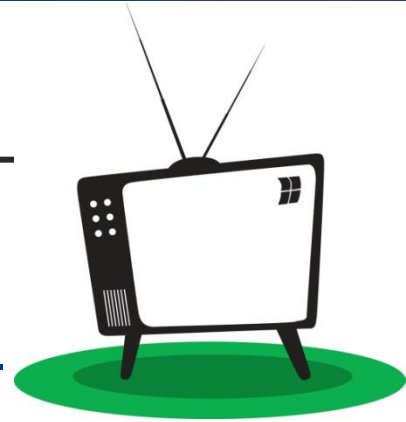
The Analytic Solution

- 😊 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.

Online Video Rental



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*.

Casino



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.

Telco



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.

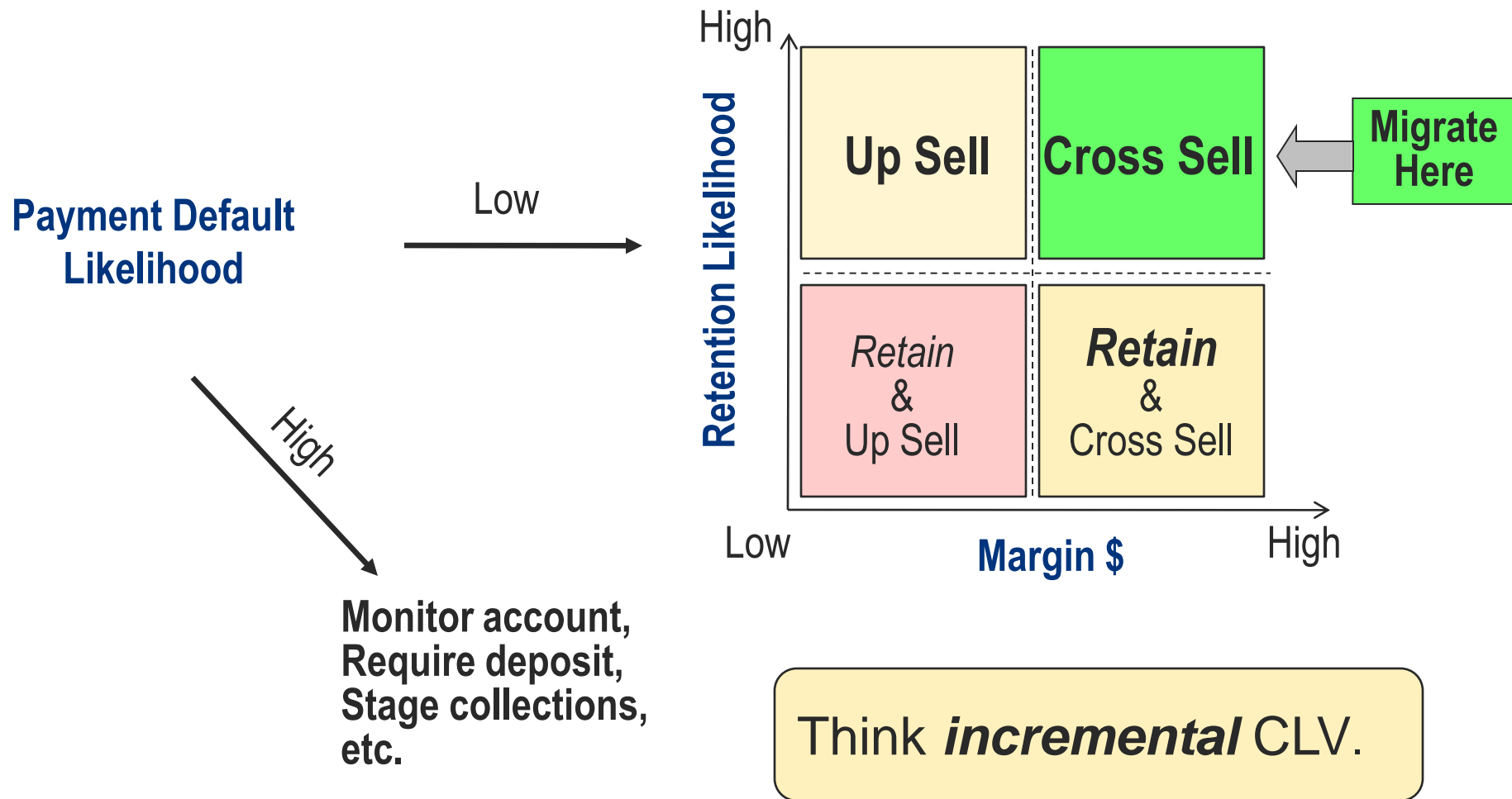
The CLV Benefit

- 😊 Scenario analysis for macro investments, quantifying incremental CLV, to determine optimal allocation of budgets.

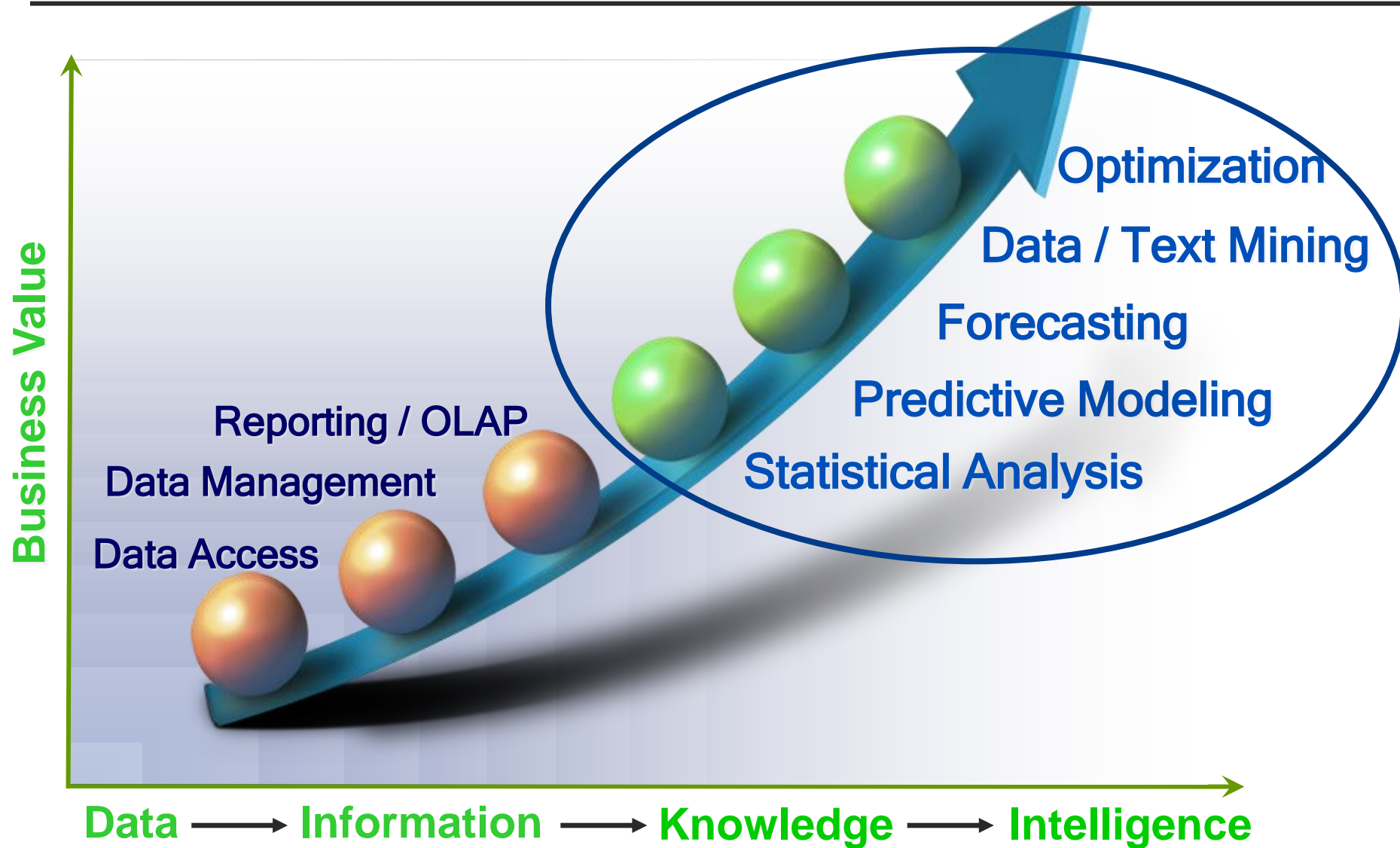
CLV – (we are approaching the last slide)

- ***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



SAS Analytics





Customer Lifetime Value

Q&A

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