

Nonlinear trade-offs in customer acquisition and retention

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Abstract

The nonlinear trade-off between customer acquisition and retention presents a critical challenge in marketing strategy. While both are essential for sustained business growth, they draw on shared, limited resources and influence growth trajectories in distinct—and often nonlinear—ways. Overinvesting in customer acquisition can lead to churn-heavy expansion, resulting in high costs and unsustainable growth. Conversely, overemphasizing retention may constrain short-term expansion but can paradoxically strengthen acquisition through improved brand reputation and customer advocacy. These nonlinear interdependencies mean that small imbalances in resource allocation can produce disproportionately large outcomes, including volatile or even chaotic growth dynamics. As a result, marketers must continuously recalibrate their acquisition–retention strategies, guided by data-driven insights, contextual awareness, and long-term objectives. However, this process must be approached with caution: even minor adjustments or prudent, incremental refinements can introduce deterministic chaos, leading to instability and unpredictability in acquisition and retention dynamics. Understanding these nonlinear effects, and their potential, such as chaos being a necessary condition for ontogeny and innovation, is crucial for designing sustainable marketing strategies.

Keyword: Customer Acquisition, Customer Retention, Nonlinear Trade-offs, Deterministic Chaos

1. Introduction

Customer acquisition and customer retention (AR) are both fundamental pillars of business growth and sustainability (Reinartz & Cumar, 2003; Lianos & Sloev, 2016, Voss & Voss, 2008). However, they compete for limited resources: budget, time, talent, and attention (Kumar &, Reinartz, 2016; Livne et al., 2011; Min et al., 2016). This trade-off is not simply a matter of dividing efforts evenly—it is inherently nonlinear. Investing more in one area does not result in proportional gains. We will demonstrate that, under specific conditions, the evolution of new customer acquisition and the retention of existing customers can transition into deterministic chaos. As a result, the system may exhibit long-term unpredictability, where small differences in initial conditions lead to drastically different long-run outcomes.

2. Understanding the trade-off

Customer acquisition refers to the strategies and efforts made to attract new customers to a business. We refer to marketing activities such as digital advertising, search engine marketing, influencer partnerships, public relations, and product trials. On the other hand, customer

retention refers to the strategies used to keep existing customers engaged, satisfied, and loyal over time. These include email marketing, loyalty programs, personalized experiences, exceptional customer support, and post-purchase engagement.

In theory, a business would do well to invest equally in both. However, in practice, budgets are limited, and marketing teams must prioritize. This forces a trade-off: investing more in customer acquisition typically means less resources in retention—and vice versa (Tsao, 2013). This trade-off becomes particularly important in highly competitive markets, early-stage startups with a finite runway, or during economic downturns when efficiency becomes paramount.

The consequence is a nonlinear co-evolution of the number of new and retained consumers. Retention has a compounding effect that makes it disproportionately impactful over time. Loyal customers (Nasir, 2017) tend to make repeat purchases, refer others, and cost less to serve. As a result, even small improvements in retention can have a significant impact on long-term profitability. Conversely, neglecting retention may not immediately affect revenue, but it creates a leaky bucket scenario in which acquisition spending is wasted, as new customers churn out as quickly as they arrive. This creates a nonlinear risk: even minimal underinvestment in retention can drastically erode the value of otherwise effective acquisition efforts.

At the same time, over-investing in acquisition can inadvertently harm retention. For instance, aggressive promotional offers aimed at attracting new customers might alienate loyal customers who previously paid full price. A sudden influx of new users may also overload customer service teams, degrading the overall experience and prompting existing users to leave. This implies that the cost of acquisition goes beyond monetary investment—it also affects organizational focus and the quality of customer experience—introducing additional layers of nonlinearity (Reichheld, 1996).

Given the nonlinear nature of the acquisition–retention trade-off, there is no one-size-fits-all solution for optimal resource allocation. The right balance depends on several dynamic and context-specific factors (King et al., 2016). Startups and early-stage companies tend to prioritize acquisition as they seek product–market fit and aim to grow their customer base rapidly. In contrast, mature companies in saturated markets often shift their focus toward retention, especially as the cost of acquiring new customers rises.

Business models also shape strategic emphasis. In subscription-based models such as Netflix, retention is typically more critical, as recurring revenue drives customer lifetime value. In transactional models like e-commerce, acquisition may initially appear more important, but strategies such as loyalty programs and customer lifetime value optimization remain essential for profitability (Kvíčala et al., 2024). Industry dynamics play a role as well: sectors characterized by high switching costs or strong brand loyalty (e.g., financial services, luxury goods) can afford to concentrate more on retention, while commoditized markets (e.g., fast fashion, consumer electronics) may need to maintain a steady focus on acquisition to stay competitive.

Despite the intuitive appeal and apparent success of many strategies for managing the acquisition–retention trade-off (Farquhar et al., 2008), significant challenges arise from the uncertainty inherent in their implementation. This uncertainty is not limited to time lags between strategic actions and observable results, or the constantly shifting nature of market environments. It also stems from a deeper, intrinsic uncertainty rooted in the nonlinear evolution of customer dynamics. In this context, the interaction between acquisition and retention can exhibit chaotic behavior (Strogatz, 2024), in which outcomes become highly sensitive to initial conditions. This chaos renders future performance difficult to predict and

manage, challenging more deterministic approaches (e.g., Fader & Hardie, 2007; Ovchinnikov et al., 2014) and calling for new frameworks that can account for the complexity and instability of these systems.

3. The model

We model the nonlinear trade-off evolution between customer acquisition and retention through the following discrete system:

$$R_{t+1} = a - bA_t \quad (1)$$

$$A_{t+1} = -cR_t + dR_t^2 \quad (2)$$

with not negative coefficients. A and R may represent the number of newly acquired and retained customers, respectively. They can also be interpreted as the corresponding growth rates. The coefficients b and c represent the proportion of resources allocated to acquisition (A) and retention (R), respectively. Since the total resource allocation is fixed, we can assume $b + c = 1$, and therefore $c = 1 - b$.

The parameter a represents the number of retained customers at time $t + 1$ when $A_t = 0$. It can be considered an intrinsic property of the product or service that drives customer loyalty. The parameter d captures the nonlinear effect of investments in retention—and the resulting number of retained customers—on the number of new acquisitions.

At time $t+1$, customer retention (i.e., the number of retained customers) negatively depends on the resources allocated to customer acquisition (or the number of new customers). This reflects a kind of "jealousy" among existing customers: when companies focus heavily on attracting new customers, current customers may perceive this as a loss of exclusivity or reduced attention. As a result, the perceived value of being a client may decrease (see Equation 1).

Customer acquisition A_{t+1} at time $t+1$ also negatively depends on customer retention R_t , reflecting the inherent trade-off between acquisition and retention. However, beyond this linear relationship, a high R_t can have a positive, nonlinear effect on acquisition at time $t+1$. This is because efforts and strategies aimed at retaining existing customers enhance the perceived value of becoming a new customer (see Equation 2), as prospective clients expect to receive consistent and growing benefits.

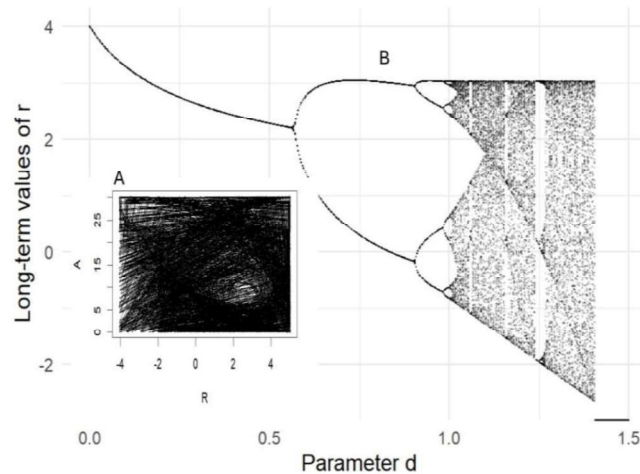


Figure 1: A: Dense trajectories of R and A as typical of chaotic behavior, parameters fixed at: $a=5$, $b=0.3$, $c=0.5$; $d=1.3$; initial conditions: $R=1.1$; $A=1.3$. B: bifurcation in the long-run values of customer retention as parameter controlling nonlinearity (d) changes. The other parameters are fixed at: $a=3$; $b=0.5$, initial conditions: $A=R=1$. System (1-2) may transit to deterministic chaos for some specific values of the model parameters a , b , c , d , e . Nonlinearity controlled by parameter d trigger bifurcations in the long-run values of the considered variable, as typical of chaotic behavior (See Fig. 1 B).

4. Conclusion

The nonlinear trade-off between customer acquisition and retention is a central issue in both marketing theory and practice. While both are essential, they compete for scarce resources and influence growth in very different—and often nonlinear—ways. Over-investing in acquisition can lead to churn-heavy growth that is costly and unsustainable. Conversely, overinvesting in retention may leave growth opportunities untapped, although, in nonlinear fashion, it can also positively impact acquisition. Understanding the nonlinear dynamics of this trade-off is critical: effects compound over time, and small imbalances can produce outsized consequences, including chaotic behavior. Smart marketers must continually recalibrate their strategies, guided by data, context, and long-term goals. However, this recalibration must be approached with caution, as it may not always increase opportunities and can, under certain conditions, trigger unmanageable and unpredictable outcomes. The identified nonlinear trade-off between Acquisition and Retention may be amplified or diminished depending on the specific industry, business model, or market context. Based on this short contribution a full-length paper investigates the effect of A-R dynamics for different strategies governed by parameter b . The full paper identifies conditions for stability, instability, and chaos, and discusses the impact of strategies that are not constant but depend on the observed composition of customers over time.

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