Customer Acquisition and Customer Retention in a Competitive Industry

Gerasimos Lianos and Igor Sloev

Abstract We study optimal customer acquisition and retention strategies in an infinite-horizon model of dynamic competition. We find that acquisition expenditures constitute the larger share of the marketing budget, when the customer profit margin is either low or large, but for intermediate profit margin values, firms spend more resources for customer retention. If customer profit margins rise for exogenous reasons, we find that the share of customer acquisition expenditures in the marketing budget increases in markets with high profit margins, whereas it decreases in markets with low profit margins. The impact of entry of new firms in the market on the optimal strategy depends on the effect of the entry on profit margins and absolute levels of profit margins. A similar phenomenon may also appear in a single segmented market: the impact of higher competition on the luxury and mass-consumption segments of a market would be different.

Keywords Customer acquisition • Customer retention • Competition • Customer lifetime value

Introduction

Why in some industries are firms more eager to acquire new customers, whereas in other industries firms are more eager to retain old customers? What factors determine the optimal allocation of marketing resources between customer acquisition and customer retention? How do market characteristics and competitive forces affect optimal customer acquisition (CA) and customer retention (CR) strategies? These questions have been a subject of inquiry by marketing scientists and marketing practitioners over the last 20 years (Venkatesan and Kumar 2004; Thomas et al. 2004).

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L. Petruzzellis, R.S. Winer (eds.), *Rediscovering the Essentiality of Marketing*, Developments in Marketing Science: Proceedings of the Academy of Marketing Science, DOI 10.1007/978-3-319-29877-1_111

A fundamental concept for answering questions related to customer acquisition and customer retention has been that of Customer Lifetime Value (CLV), that is, the present value of the stream of profits accruing to a firm over the whole period of its relationship with a customer (Berger and Nasr 1998; Gupta et al. 2006). Several studies have used CLV to analyze optimal CA and CR strategies in *a single-customer/single-firm* framework. Blattberg and Deighton (1996) have presented a model of maximization of CLV giving rise to optimal allocation of marketing expenditures to CA and to CR. Berger and Nasr (1998) have further developed the model considering different customer segments and distinguishing between retention expenses and add-on selling including up-selling and cross-selling. Berger and Bechwati (2001) have used the model to examine the maximization of customer equity and optimal allocation of resources under binding condition on a promotional budget. Tsao (2013) has extended Blattberg and Deighton's model to study optimal acquisition and retention when a firm wants simultaneously to increase its market share and maximize customer equity.

Blattberg et al. (2008) summarize the findings of analytical studies. The CA and CR response curves are the key drivers of relative and absolute spending. Marginal cost (not average cost) should guide investments in CA and CR. In a single period model with an unlimited marketing budget, firms should increase their spending on CA until the marginal acquisition cost equals the lifetime value of the customer. Similarly, they should also increase spending on CR until the marginal cost of retaining another customer equals the lifetime value of the customer, adjusted for a one-period discount rate. Improvements in CA response affect CA investment but not CR investment, whereas improvements in CR response affect both CR and CA investments. Budgeting results in locally suboptimal spending. Companies with a larger installed customer base should spend more on CR, although they should possibly decrease these expenditures over time.

A few studies have analyzed the explicit effects of competition and the marketplace on a firm's optimal CA and CR strategies (see Verhoef et al. 2007; Kumar et al. 2006 for a discussion). Syam and Hess (2006) have built an analytical model to investigate the optimal CR or CA of an incumbent firm when faced with the threat of entry by a new firm. Fruchter and Zhang (2004) have analyzed the strategic use of targeted promotions for CA and CR in dynamic duopoly settings with firms of different size. They show that a firm with a larger market share should focus on CR whereas a firm with a smaller market share should focus on CA. Martin-Herran et al. (2012) have investigated the optimal spending allocation between CA and CR in a dynamic market when two firms compete for market share and they have showed that a firm's CR expenditures can either increase or decrease with its own market share depending on the parameters of the model.

A number of studies have used statistical/econometric models to address the optimal allocation of the marketing budget between CA and CR. Thomas (2001) have introduced a Tobit model to study CA and CR and applied it to data and showed that different variables drive the acquisition and lifetime in different customers segments. Reinartz et al. (2005) have extended Thomas's model by adding customer profitability into consideration and found that underspending on CR and CA is more detrimental and results in smaller returns on investment compared to overspending. Rust et al. (2004) have proposed a statistical model accounting explicitly for the relationship between a focal brand and competitors' brands. They have shown how firms can analyze drivers that have the greatest impact on profits, compared the performance of the drivers with that of the competitors' drivers, and estimated the return on investment in improvements of the drivers. Voss and Voss (2008) have given insights on the impact of market competition on optimal firm strategies in a framework of a static oligopoly model with symmetric firms and shown that firms may benefit from shifting their marketing strategy's focus from CR to CA when competition density increases.

In this chapter we present an analytical model of optimal CA and CR strategies in dynamic market interactions among many firms. We analyze how changes in the customer profit margin and the concentration of firms reshape the optimal marketing strategy (CA and CR expenditures and their shares in marketing budget) and the market outcome (size of firms, number of untapped customers, churn rate) in the long run. One of the distinguishing features of our approach is the consideration of endogenous mark-ups, which gives us a number of new insights into the optimal allocation of the budget.

The Model

Let $I \in (0, M]$ be the set of firms in the industry and let $i \in I$ be the index of an individual firm in the industry. All firms provide customers with a similar service. Examples of firms are internet providers, banks offering credit card service, and insurance companies. There is a fixed number N of identical customers. Let $l^i(t)$ be the number of customers served by firm i at time t. The number of potential (untapped) customers in the market is given by:

$$N^p(t) = N - \int_0^M l^j(t)\,\mathrm{d}j \tag{1}$$

We assume that each customer purchasing a service from a firm generates a gross-of-marketing-cost per-capita profit margin m to that firm. We assume that m is constant over time (however, we allow it to depend on M).

Following Erickson (2009) we assume that CA works through attracting untapped customers. Let $A^i(t) > 0$ be the CA expenditure made by firm i at time t. The share of potential customers that choose firm i at time t is determined by the CA expenditure the firm makes relative to all other firms in the industry according to the rule:

$$s^i(t) = A^i(t)^\theta \Big/ \int_0^M A^j(t)^\theta\,\mathrm{d}j \tag{2}$$

where $\theta \in (0, 1)$ reflects the degree of decreasing returns to the CA expenditure. That is, s^i increases at a decreasing rate in A^i and it decreases in the competitors' CA expenditures. As an example of such an acquisition effort one may think of combative advertising in markets where customers are well informed about the existence of a product/service (Bagwell 2007; Chen et al. 2009).

The number of new customers for firm i at time t is given by:

$$N_0^i(t) = s^i(t) N^p(t). \tag{3}$$

Each firm i at every period t chooses the level of retention expenditure for each customer, $e^i(t) \geq 0$. (As all customers are identical this level is the same for all customers). The CR expenditure decreases the attrition rate of customers and it determines the fraction of the time-t customers who defect at time t from the firm, $\beta(e^i(t))$. Examples of such retention actions are loyalty programs offering personalized bonuses (Blattberg et al. 2008; Kumar 2008; Dorotic et al. 2012). We assume that the shape of $\beta(\bullet)$ is the same across customers and across firms. We also assume that function $\beta(e)$ is continuously differentiable, strictly decreasing, and convex, something consistent with empirical findings (Reinartz et al. 2005). To ensure the existence and uniqueness of equilibrium, we also assume that: $-\beta'(0) \geq 2/m$, $\ln(\beta)'' > 0$. Spending $e^i(t)$ on each customer a firm's total CR expenditures at time t are as follows: $E^i = e^i(t) l^i(t)$.

Given marketing decisions by firm i at time t, the number of its customers decreases at an endogenous rate $\beta(e^i(t))$ and increases by the number of newly acquired customers $N_0{}^i(t)$. Thus, the law of motion of the number of customers at any moment is given by:

$$\frac{\mathrm{d}l^i}{\mathrm{d}t} = -\beta\left(e^i(t)\right) l^i(t) + N^p(t) s^i(t). \tag{4}$$

The instantaneous profit of firm i at time t is given by:

$$\pi^i(t) = m l^i(t) - \left\{ e^i(t) l^i(t) + A^i(t) \right\}, \tag{5}$$

where $ml^i(t)$ is the gross-of-marketing-costs operations revenue and $e^i(t)\, l^i(t) + A^i(t)$ is the total marketing cost.

Let $\rho \in (0, 1)$ be the discount rate. The manager of firm i at the initial time $t = 0$ chooses the time paths of the CA expenditures, $A^i(t)$, the CR expenditures, $e^i(t)$, and the number of customers $l^i(t)$ to maximize the present discounted value of the firm's profits:

$$W^i = \int_0^\infty \exp[-\rho t] \pi^i(t) \mathrm{d}t \tag{6}$$

subject to (4), given the initial number of customers $l^i(0)$, and taking the paths of the choices made by the other firms as given.

The Symmetric Long-Run Equilibrium

In the symmetric equilibrium of the industry, all firms make the same choices for the decision variables. Moreover, in the steady state, the optimal policy is time invariant: $e^i(t) = e^*$, $A^i(t) = A^*$, $l^i(t) = l^*$. In Appendix, we show the existence, uniqueness, and saddle-path stability of the symmetric equilibrium and derive the expressions for the optimal policy. The firm's optimal CA expenditures in the steady state are given by following condition:

$$-\beta'\left(e^*\right)\frac{m-e^*}{\beta\left(e^*\right)+\rho}=1. \tag{7}$$

Let us denote $\nu^* = (m - e)/(\beta(e^*) + \rho)$. Given the discount factor ρ, ν^* is equal to the net present value of the flow of constant net profit margins $m - e^*$ of a customer who is retained with the constant rate $1 - \beta(e^*)$. Therefore, (7) equates the marginal cost of CR expenditure (which is unity) to its marginal benefit, which is the product of the customer value, ν^*, and the increase in the retention rate $-\beta'(e^*)$. In the following, we use the notation $\beta^* = \beta(e^*)$ for the constant equilibrium attrition rate.

In the steady state, the size of the firm and the number of potential customers are given by the following expressions:

$$l^* = \frac{N}{M}\frac{1}{1+\beta^*}, \quad N^p = N\frac{\beta^*}{1+\beta^*}. \tag{8}$$

Finally, optimal CA expenditures in the steady state are given by:

$$A^* = \theta v^* N^{p^*}. \tag{9}$$

We should note that the acquisition technology has no impact on the optimal CR expenditure. However, the opposite is not true: the retention technology does have an impact on the optimal CA expenditure. Indeed, the shape of $\beta(\bullet)$, together with ρ and m, determines the customer value ν^* and the number of potential customers and thus affects the optimal CA strategy. This is similar to the one obtained in single-period models; here we show that it also holds in a long-run equilibrium of dynamic interactions.

Impact of the Profit Margin

An application of the implicit function theorem to (7) immediately gives the following proposition.

Proposition 1 A higher value of the profit margin m corresponds to higher steady-state values of per-customer retention expenditures e^*, the net profit margin $(m - e^*)$, and the customer value v^*. A higher value of the profit margin m corresponds to the lower value of the effective attrition rate, β^*.

In the steady state, the number of newly acquired customers is equal to the number of customers defecting from their service providers. Thus β^* determines the churn rate (defined as the share of customers who defect). This is expressed in the following proposition.

Corollary 1 *The churn rate in steady state depends negatively on the profit margin.*

A question of interest for marketing scientists is: "why do some firms spend more on CA than on CR, while others do the opposite?" Fruchter and Zhang (2004) use the ratio of CA expenditures to CR expenditures at firm level to determine the focus of the marketing strategy; they state that a firm's strategy is *more offensive (defensive) strategy* when this ratio is larger (lower). Following Fruchter and Zhang, we introduce a similar measure defined as the share of CA expenditures in the total marketing budget in the steady state, $S_A = A^*/(A^* + E^*)$. If firms spend much more for CR than for CA, S_A is close to zero; if the situation is reversed, S_A is close to unity.

Many normative studies have considered a single-customer/single-firm relationship and so have operated with per-customer values of CA and CR expenditures. To make our results comparable with them, we introduce a measure that reflects the ratio of CA to CR expenditures in per capita terms. Spending A^*, a firm acquires N_0^* new customers. Thus, $a = A^* / N_0^*$ is the *per-new-customer* acquisition expenditure, showing how much the firm effectively spends to acquire a single customer. In all consequent periods, the firm spends e^* to retain this customer. Thus, we define $s_a = a^*/(a^* + e^*)$. Note that s_a is close to one if the firm spends much more on acquiring a single customer than on retaining this customer in each period; s_a is close to zero, if the opposite holds.

Using $N_0^* = N^{p*} / M$ and (8) and (9), s_a and S_A may be written as follows:

$$S_a = \frac{1}{1 - \beta' e / \theta}, \quad S_A = \frac{1}{1 - \beta' e / (\beta\theta)}. \tag{10}$$

The following example illustrates that the impact of changes in m on s_a and S_A is not monotone.

Example 1 Blattberg and Deighton (1996) proposed an exponential specification for the retention curve, which later has been widely used (Blattberg et al. 2001, 2008; Pfeifer 2005; Tsao 2013). Adapted to our notation, it takes the following form:

$$\beta(e) = 1 - (1 - \beta_L)(1 - \exp[-ce]), \tag{11}$$

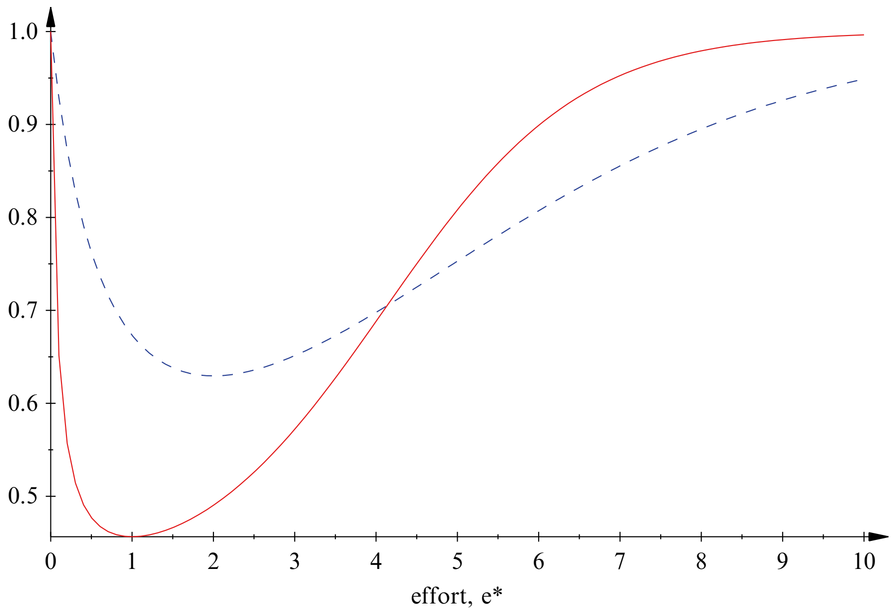

Fig. 1 S_A (*solid line*) and s_a (*dashed line*) as functions of e

where $\beta_L \in (0, 1)$ is the lower limit of the attrition rate, which may be reached at infinite cost, and the parameter $c>0$ determines the shape of the curve. For this functional form, from (10) we obtain the following:

$$\operatorname{sign}\left[\frac{\mathrm{d}s_a}{\mathrm{d}e}\right]=\operatorname{sign}\left[ce-1\right],\quad \operatorname{sign}\left[\frac{\mathrm{d}S_A}{\mathrm{d}e}\right]=\operatorname{sign}\left[\beta_L\left(ce-1\right)-\left(1-\beta_L\right)\exp\left[-ce\right]\right].$$

This implies that $s_a(e)$ has a unique minimum at $e=1/c$. Because $e^*(m)$ is monotone in m, s_a has a unique minimum in m. Whenever $\beta_L>0$, S_A also has a unique minimum in e, and therefore in m. However, if $\beta_L=0$, then $\mathrm{d}S_A/\mathrm{d}A<0$ for all e, that is, S_A monotonically decreases in m. Figure 1 displays functions $S_A(e^*)$ and $s_a(e^*)$ for $c=½$, $\beta_L=1/5$, $\theta=½$.

The intuition of these results is the following: If m is low, then the CR expenditures (both e^* and E^*) are low. However, as the set of potential customers N^{p*} is relatively large, A^* is also relatively large. In such a case, an increase in m raises the optimal levels of the CR expenditures (both e^* and E^*) significantly. As the result both S_A and s_a decrease in m for low values of m.

Whenever the lower limit of the attrition rate is positive, the set of potential customers never vanishes. When m becomes large, the level of CR expenditures also rises and the marginal effect of a further increase in e^* on the attrition rate becomes small. Thus, a further increase in m leads to small changes in both e^* and N^{p*}. However, v^* increases almost proportionally to m, and thus both a^* and A^* do so as well. Therefore, both s_a and S_A increase.

We summarize these findings in the following proposition.

Proposition 2 Suppose $\beta(e)$ is given by (11) with $\beta_L > 0$. (*i*) A higher profit margin m results in a larger-sized firm (higher l^*), higher per-new-customer acquisition expenditures, a^*, and higher CR and CA expenditures at the firm level, E^* and A^*. (*ii*) An increase in m lowers both s_a and S_A when m is low and raises both s_a and S_A when m is large.

It follows from Example 1 that whether a firm's strategy becomes more or less oriented toward CA after a change in the profit margin depends to a great extent on the measure chosen: a decrease in S_A may be accompanied with an increase in s_a. Recall also that, by Corollary 1, the equilibrium churn rate is equal to β^* and always decreases in m. If m is low, an increase in m, according to both measures, makes firms' strategy more retention-oriented and accompanied with a lower churn rate. This is consistent with intuition. However, if m is sufficiently large, an increase in m makes firms' strategy *less retention-oriented*, whereas the *churn rate still decreases*. This is due to the fact that both s_a and S_A are based on relative expenditures, whereas β^* is determined solely by per-customer retention expenditures. Thus, an increase in both CA and CR expenditures may lead either to a decrease or an increase in their ratio, while the churn rate always decreases.

The Role of Competition

We start with the case of the profit margin independent of the number of firms, $dm/dM = 0$. Equation (7) does not include M; thus the number of firms has no impact on e^* and therefore on β^*. Together with (8)–(10), this provides the following result.

Proposition 3 Suppose $dm/dM = 0$. (*i*) An increase in competition strength (higher M) has no impact on e^* and ν^*; however, a higher M leads to a lower l^*. (*ii*) Both shares S_A and s_a are independent of the number of firms.

According to both economic theory and empirical observation a lower concentration of firms (higher M) tends to raise competition strength and to have a negative impact on prices. Thus, it is reasonable to assume that a higher level of M results in a lower per-customer profit margin, $dm/dM < 0$. Combining Propositions 2 and 3, we obtain the following statement.

Proposition 4 Suppose $dm/dM < 0$ and $\beta(e)$ is given by (11) with $\beta_L > 0$. (*i*) Stronger competition (higher M) leads to lower e^*, ν^*, and l^*. (*ii*) An increase in M raises both S_A and s_a when m is small, and lowers both S_A and s_a when m is large.

Note that, while m decreases in M, it does not imply that m is high when M is small, because m may be bounded from above at a level determined by properties of consumers' demand (which are orthogonal to our model). Moreover, it is not necessary that a high level of M leads to a very low level of m. As we have mentioned earlier for special consumers' preferences it even holds that m is independent of M.

Thus, in general, m may be bound from below as well as from above. The extent of indirect impact of competition is determined by the magnitude of its impact on profit margins. If the impact on profit margins is large, then the effects described in Proposition 4 are quantitatively large as well.

Conclusion

Model Limitations and Robustness

We have assumed that the shape of the attrition function does not change over time and it is the same across customers. Customer-loyalty or the cost of switching supplier, however, may be increasing over time during the period the customer stays with the firm (Gupta and Lehmann 2003; Blattberg et al. 2008). Moreover, the marketing literature (Fader and Hardie 2007, 2010) suggests that customers are heterogeneous in their attrition intentions. Capturing such heterogeneity would be an interesting extension of the present model.

We have assumed that an individual firm is inconsequential to the market. That is, whereas a joint behavior of many firms has an impact on the optimal strategy of each firm, actions of any individual firm have no impact on the market or on rivals' strategies. Clearly, this does not hold in markets with a few large firms behaving strategically.

In our model firms' acquisition activities determine the distribution of new customers across individual firms but they do not change the total number of consumers attracted by all firms. This is a good assumption for markets with a finite set of well-informed customers and combative advertising as the main acquisition channel. In other cases, however, as for instance in a market for newly introduced, innovative products, acquisition activity may increase the number of new customers, so that the whole customer base may grow over time.

Contributions and Implications

The results in Proposition 1 are in line with the results obtained in simpler models. Here, we show that these results also hold in the case of dynamic competition. The results in Propositions 2–4 give new insights and implications. Our analysis predicts that CA expenditures constitute the larger part of the marketing budget when the profit margin is either low or relatively large; however, for intermediate profit margin values, firms tend to spend more resources for CR. Moreover, if the customer profit margin rises for exogenous reasons, the effect on markets with high profit margins may be very different from the effect on markets with low profit margins. Although both CA and CR expenditures increase in both cases, the share of CA expenditures in the marketing budget increases in the former situation and decreases in the latter.

If institutional or technological changes bring new firms to the market, the impact on the optimal strategy depends on the effect on profit margins as well as on their absolute levels. This phenomenon may also appear in a single segmented market; the impact of higher competition on the luxury and mass-consumption segments would be different. This should be taken into consideration if the theoretical predictions of the model are to be tested with real data.

We have conducted the analysis in terms of two metrics: the ratios of CA and CR expenditures in the total marketing expenditure at both the firm and the per-customer level. These metrics characterize the optimal marketing budget distribution, however they should be interpreted with caution. Based on these metrics, a more retention-oriented strategy does not imply a lower customer churn rate.

The normative implications of the model may be of value to marketing and customer relations managers who, faced with the challenge to respond to perceived changes in the market environment, they often have to resort to rule-of-thumb and short-term tactics based on very simple conjectures about how short-term reactions will affect long-term outcomes.

Appendix 1: Characterization of the Equilibrium of the Firm

We write the Hamiltonian function as follows: $H^i = \exp[-\rho\ t]\{(m - e^i)l^i + \lambda^i\{-\beta\ l^i + N^p\ s^i\}$, where λ^i is a co-state variable. As $\mathrm{d}N^p/\mathrm{d}l^0 = 0$ and $\mathrm{d}s^i/\mathrm{d}A^j = 0$, the first-order conditions are as follows:

$$\lambda^i\left(-\frac{\mathrm{d}\beta^i}{\mathrm{d}e^i}\right) = \exp\left[-\rho t\right], \tag{12}$$

$$\lambda^i N^p\left(\frac{\mathrm{d}s^i}{\mathrm{d}A^i}\right) = \exp\left[-\rho t\right], \tag{13}$$

$$\frac{\mathrm{d}l^i}{\mathrm{d}t} = -\beta^i l^i + N^p s^i, \tag{14}$$

$$\frac{\mathrm{d}\lambda^i}{\mathrm{d}t} = -\exp\left[-\rho t\right]\left(m - e^i\right) + \lambda^i\beta^i. \tag{15}$$

The solution paths must also satisfy the transversality condition, $\lim_{t\to\infty} \lambda^i = 0$. Equations (12) and (13) combined give the condition:

$$N^p\left(\mathrm{d}s^i / \mathrm{d}A^i\right) = -\left(\beta^i\right)'. \tag{16}$$

Differentiating equation (12) with respect to t and substituting the result into (15), we obtain the expression:

$$\frac{\mathrm{d}e^i}{\mathrm{d}t} = -\left[\left(\beta^i\right)'\left(m - e^i\right) + \left(\beta^i + \rho\right)\right]\frac{\left(\beta^i\right)'}{\left(\beta^i\right)''}. \tag{17}$$

For the symmetric long-run equilibrium, (1), (14), (16), and (17) provide (7)–(9). It may be shown that the function H^i is quasi-concave jointly in (e^i, A^i, l^i). Hence, a path that satisfies the first-order necessary conditions gives the optimal solution.

Appendix 2: Existence and Uniqueness of the Long-Run Equilibrium

Considering the optimal path of e determined by (17), we define $G(e) \equiv \beta'(e)(m-e) + \beta(e) + \rho$. It can be seen that $G(0) < 0$, $G(e)$ monotonically increases in e on [0, m], $G(m) > 0$ and $G(e)$ is positive and decreases in e for all $e > m$. Therefore, for $e \in [0, m]$, there exists the unique e^*, such that $G(e^*) = 0$. Thus, $e(t) = e^*$ is the unique stationary solution of $\mathrm{d}e/\mathrm{d}t = 0$.

For paths that start at $e > e^*$, we have $\mathrm{d}e/\mathrm{d}t > 0$, which implies $e(t) \to \text{const} > m$, as $t \to \infty$. These paths cannot be equilibrium, as firms get negative per-period profit in the long run. For paths starting at $e < e^*$, we have $\mathrm{d}e/\mathrm{d}t < 0$, so they lead to $e = 0$. These paths cannot be equilibrium paths: marginal retention expenditures at unit marginal cost would bring the positive next-period gain $-\beta'(0)\ m > 1$ and would therefore increase the profit.

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