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The dynamic effect of customer equity across firm growth: The case of small and medium-sized online retailers☆

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ABSTRACT

Although several causal studies investigate the relationships between customer equity and firm performance, some debate about whether their positive relationship is valid over long time horizons and across firm/industry environments does exist. This study investigates the dynamic effect of customer equity on firm performance. Using individual-level purchase data for an online retailer, the results show a weak relationship between customer equity and firm profitability, which is not consistent with previous assumptions and beliefs. Additional analysis to resolve this gap shows that in the early stage when a firm's growth rate is relatively high the firm is required to manage many newly enrolled customers. In contrast, in the mature stage when a firm's growth rate is stable and low the firm should retain its customers. Thus, marketing managers need to leverage the drivers of acquisition and retention to continue to grow overall customer equity and firm performance.

1. Introduction

Acquiring customers and retaining them are two of the most important aspects of marketing, especially from the practical perspective. Companies thus put tremendous effort into effectively managing customers and many researchers have studied this issue. Concurrently, studies on customer relationship management (CRM), customer lifetime value (CLV), and customer equity (CE) have become important topics. With the growing importance of customer value, marketing scholars have suggested that CE, which is the sum of CLV of the firm's customers, can be the alternative measure of firm performance (Bejou & Gopalkrishnan, 2014; Mark, Lemon, Vandenbo, Bulla, & Maruotti, 2013; Song, Kim, & Kim, 2013; Srinivasan & Hanssens, 2009; Wiesel, Skiera, & Villanueva, 2008). Because of the rapid development of information technology, research results of such topics are increasingly being used in areas such as customer-value-based segmentation, optimal resource allocation, and company value evaluation (Jai & Tung, 2015).

With the growing interest in CE, several causal studies have investigated the relationships between CE and firm performance (Gupta, Lehmann & Stuart, 2004; Gupta & Zeithaml, 2006; Kumar & Shah, 2009). Most of them provide substantial and widespread conceptual and empirical evidences of the positive link between CE and firm performance either directly or through improved customer outcomes (Blattberg, Malthouse, & Neslin, 2009; Chae, Ko, & Han, 2015; Gupta & Zeithaml, 2006; Hogan, Lehmann, Merino, & Verhoef, 2002; Kim, 2015; Kim, Ko, Lee, Mattila, & Kim, 2014; Kumar & Shah, 2009; Rust, Lemon, & Zeithaml, 2004; Schulze, Skiera, & Wiesel, 2012; Silveira, Rovedder de Oliveira, & Luce, 2012; Sun, Kim, & Kim, 2014; Vogel, Evanschitzky, & Ramaseshan, 2008; Wiesel et al., 2008). However, apart from these cross-sectional studies, increasing demand for research investigating the relationship between CE and firm performance over time still exists. Recently, Ryals (2005) and Kumar and Shah (2009) have shown some initial evidence of how CLV is related to changes in firm performance over time. Kumar and Shah (2009) emphasize the business environment, which can be changed over time; therefore, this study will address this issue in relation to firms' internal factors (e.g., the firm's growth rate), as shown in Reinartz, Thomas, and Kumar (2005). Some researchers have raised the possibility of a negative short-term outcome of CRM strategies depending on the lifecycle stage. For example, because of the large investment, adaptation to new strategies, and strong focus on technology required, the short-term consequences of CRM may be negative (Verhoef et al., 2010).

Russo and Fouts (1997) find that environmental factors like growth rate can affect firm performance in different ways. Kumar and Shah (2009) argue that a positive relationship between CE and firm performance may not be valid for longer time horizons, in which firms in general may eventually experience a slowdown in business due to the increasing difficulty of acquiring profitable customers, which leads to

Abbreviations: CE, Customer equity; RCE, Retained customer equity; NCE, Newly acquired customer equity; CRM, Customer relationship management; CRV, Customer lifetime value.

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diminishing contribution margins over time. The purpose of this research is, first, to investigate the long-term effects of customer equity (CE) on profitability across firms' environmental factors. Although the high correlation between firm performance and CE seems to be undoubtedly because the concept of customer lifetime value (CLV) is based on the profitability of an individual customer, their relationship is not straightforward because of the following conceptual differences between CE and CLV. First, CE considers the CLV of all users (including the growth in the number of customers) rather than that of each individual user. Drèze and Bonfrer (2009) show that the transition from CLV to CE is more complicated. Second, the estimated future profit is not directly related to immediate and short-term profit, because most CLV estimation models employ the entire history of the previous buying behaviors rather than only that of the immediate buying behavior, covering the long-term income stream (Gupta et al., 2004). Rather, in this study, we anticipate a significant difference among these correlations over longer time horizons due to the long-run characteristics of CLV and CE. As shown by the results of the current analysis, a few cases that show the obvious relationship between CE and profit (only 6 among 30 cases exhibit a significant relationship between CE and profit) support this argument. Thus, verifying the direct and dynamic relationship between CE and firm profitability with empirical data is a significant research topic. The other purpose of this study is to examine the dynamic effects of CE on firm performance and compare these effects to firms' environmental factors such as firm growth rate.

2. Theoretical background and hypotheses

2.1. Customer equity and firm growth rate

The previous literature shows high correlation between CE and firm financial performance. Previous researchers have argued that CLV and CE can be good indicators of a firm's market value. For example, Gupta et al. (2004) empirically study this issue by estimating the CE (or future customer value) of each of four online firms and one offline firm and explain the relationships between the estimated CE and the firms' stock prices. Recently, using the marketing dynamics perspective, researchers have aimed to model the different effects of marketing actions and policies on firm performance. More importantly, the dynamic effect of marketing efforts has received much attention from marketing practitioners and academics (Leeflang, Bijmolt, van Doorna, Hanssens, van Heerdec, Verhoef & Wieringaa, 2009; Song, 2014; Song, Kim, & Ko, 2014).

Russo and Fouts (1997) find that environmental factors such as firm's resources have different effects on firm profitability. Firm profitability can be influenced by customer type, and this effect is also influenced by internal firm factors such as firm size, reputation, and growth rate (Kumar & Shah, 2009; Reinartz et al., 2005; Venkatesan & Kumar, 2004). Kumar and Shah (2009) contend that their results may not hold true for firms from industries that do not anticipate continuous growth. Therefore, the moderating role of growth rate on the relationship between CE and firm profitability should be demonstrated. Inclusion of a firm's growth rate factor can help explain why the firm may not experience a positive relationship between CE and profitability during all stages of the lifecycle.

Although some research has examined the static relationship between CE and performance with the time-series data (e.g., Schulze et al., 2012), little research has investigated the dynamic impact of CE on performance depending on the environmental changes. As strategic resource allocation is no doubt critical for firms, this study empirically demonstrates that customer management strategies can be applied differently and that the subsequent outcomes may hold true across a firm's lifecycle. Because the current modeling framework and dataset facilitate the computation of the lifetime value of each customer of a firm, firms can deploy different marketing tactics and strategies for each period for each customer segment.

2.2. Classifying customer equity

Researchers have proposed many approaches for classifying customers to efficiently allocate marketing resources. Homburg, Droll, and Totzek (2008) argue that customer classification refers to the ways in which customers are targeted with different marketing instruments according to their importance to the firm (the top tier - most important customers vs. bottom tier - least important customers). Reinartz et al. (2005) propose that customers should be categorized according to their profitability across three stages of the customer relationship: initiation, maintenance, and termination. Buzzell (1966) and Best (2000) segment customers into two groups: old and new. Some studies have contributed to the understanding of relationship management by developing a typology of relationship exchange mechanisms (Heine & Berghaus, 2014; Hogan et al., 2002; Johnson & Slenes, 2004; Maloney, Lee, Jackson, & Miller-Spillman, 2014; Wu & Chalip, 2014).

However, as Hanssens (2003, p. 16) note, the more challenging task is to assess long-run marketing effectiveness and allocate the overall marketing budget across the key activities that generate CE; thus, the issues related to establishing the customer-profitability-based decision model of the marketing resource allocation problem are important and challenging. Here, this study uses Hogan et al.'s (2002) customer portfolio management depending on the relationship strength and classify the CE based on the length of the relationship. Furthermore, Song, Kim, and Lee (2009) show the differential effects of CE of new customers and existing customers on firm profitability.

In the same manner, this research classifies CE based on the two relationship types. NCE_t refers to the summation of CLV for customers acquired at time t. RCE_t refers to the summation of CLV for customers that were existing or acquired before time t. With this classification, the current study contributes to the limited literature on customer classification by framing the pursuit of CE as a resource allocation for the guiding ideals of CRM business processes. This research also responds to the need for a better understanding of how firms can improve their performance using different CE by differentiating the effects of a customer-focused structure.

2.3. Hypothesis

Srivastava, Fahey, and Christensen (2001) have described how a company should take advantage of its resources to get customer value from the perspective of resource-based theory. Recently, Sirmon, Hitt, Ireland, and Gilbert (2011) suggest the need of research that captures the dynamics pertaining to firms in and between lifecycle stages since it could elucidate firms' operating and governance structures that in turn affect firm performance. They emphasize the importance of resource orchestration efforts across the lifecycle of a firm (Ndofor, Sirmon, & He, 2011). Petersen et al. (2009) note that research needs to continue to focus on the two components of marketing, namely customer acquisition and customer retention; therefore, this research considers the marketing resource allocation problem in terms of determining how much to spend on customer acquisition and retention efforts.

Previous research has addressed the issue of how much to spend on customer acquisition and customer retention (Blattberg et al., 2009). For example, Blattberg, Getz, and Thomas (2001) include acquisition, retention, and cross-buying in a model of CLV and CE but do not consider the specific impact of marketing expenditure on customer profitability. Thomas (2001) examines the link between customer acquisition and customer duration. Reinartz and Kumar (2000) examine the link between customer duration and customer profitability. Rust et al. (2004) address both acquisition and retention aspects, but their model does not provide for separate or distinct investments in the acquisition of new customers and the retention of existing customers. Reinartz et al. (2005) suggest that in a fixed marketing budget, firms must make a resource allocation decision between acquisition and retention efforts;

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their study concludes that spending on retention is less profitable than spending on acquisition.

According to the resource-based and resource allocation perspectives, Villanueva and Hanssens (2007) show that the acquisition process is particularly important for start-ups and firms competing in growth markets. Srivastava et al. (2001) also suggest that in the start-up stage, in order to establish viability in the marketplace (Miller & Friesen, 1984) entrepreneurs must identify, acquire, and accumulate resources. For many firms, marketing spending on acquiring customers represents an important expense, and it is widely known that the acquisition process has an important effect on future retention probability (Thomas, 2001). However, a firm tries to retain its existing customers when its growth rate is stable and it already has existing customers (Rosenberg & Czepiel, 1984).

Further, as Kumar and Shah (2009) find that a firm's growth rate is not stable during its entire lifecycle, the dynamic effect of CE on profitability for longer time horizons—over which firms may experience a slowdown in business due to the difficulty of acquiring customers—should be considered. According to Feeser and Willard's (1990) argument that high-growth firms are likely to experience more acquisition efforts than low-growth firms, this study infers that having a large volume of potential or prospective customers more likely positively affects the efficiency of acquisition efforts; but less likely affects the efficiency of retention efforts. In high-growth situations, the retention rate is dependent on the growth rate because the number of customers in the firm increases with the growth rate. This means that the growth rate can play an important role in firm performance through acquisition rate, and relatively attenuate the retention rate as well as the variation of RCE. Thus, the impact of NCE on profitability becomes greater than that of RCE in the high-growth environment. However, in low-growth situations, the retention rate is less dependent on the growth rate due to the stable customer base. Finally, the following hypotheses are proposed.

H1. The effect of NCE on firm profitability is moderated by the firm's growth rate. At a higher growth rate, the effect of NCE on profit is higher than that of RCE.

H2. The effect of RCE on firm profitability is moderated by the firm's growth rate. At a lower growth rate, the effect of RCE on profit is higher than that of NCE.

3. Model

Two models are needed to fulfill the research purpose of the current study. The first is a model to estimate CLV (hereafter, estimation model), which can then be used as a dependent variable in the other model, and the other is a model to clarify the relationship between CE and firm profitability (hereafter, relationship model), which is the ultimate purpose of this study.

3.1. Estimation for customer equity

To estimate the CLV for each customer, this research uses the BG/NBD model (Fader, Hardie, & Lee, 2005) based on the Pareto/NBD model (Schmittlein, Morrison, & Colombo, 1987). The first step is to estimate the expected transaction frequency of the customer using the BG/NBD model, which incorporates the recency and frequency of the customer transaction information. Each customer's CLV is calculated by multiplying the expected transaction frequency by the average transaction volume.

3.1.1. Customer's expected transaction frequency for estimation period (k)

As shown in [Fig. 1], a customer made his first purchase at time t_0 and his second purchase at time t_1 sequentially. Accordingly, the customer made a total of $x + 1$ purchases; the last purchase time is t_x; and the whole transaction period with the company is T. According to the BG/NBD model, [Eq. (1)] represents the expected transaction frequency of customer i at estimation period (k) during the time period t using Eq. (10) of Fader et al. (2005), which estimates the expected transaction frequency in time period T.

$$
\begin{aligned}
&E_t(Y_k(t)) \\
&= E(Y_k(t)|\chi_k = \chi_k^{(i)}, t_{\chi_k} = t_{\chi_k^{(i)}}, T_k = T_k^{(i)}, r_k, \alpha_k, a_c, b_k) \\
&= \frac{\frac{a_k + b_k + \chi_k - 1}{a_k - 1}\left[1 - \left(\frac{\alpha_k + T_k}{\alpha_k + T_k + t}\right)^{r_k+\chi_k} {}_2F_1(r_k + \chi_k, b_k + \chi_k; a_k + b_k + \chi_k - 1; \frac{t}{\alpha_k + T_k + t})\right]}{1 + \delta_{\chi_{k>0}} \frac{a_k}{b_k + \chi_k - 1}\left(\frac{\alpha_k + T_k}{\alpha_k + t_{\chi_k}}\right)^{r_k+\chi_k}}
\end{aligned}
\tag{1}
$$

[Eq. (1)] probabilistically estimates how many purchases customer i would make (an expected transaction frequency) during the future period of t based on the purchase history $(t_{x_k^{(i)}}, x_k^{(i)}, T_k^{(i)})$ of customer i with the customer's transaction behavioral parameter $(\gamma_k, \alpha_k, a_k, b_k)$ at estimation period k. Since the expected transaction frequency is from the BG/NBD model, it can be estimated through maximum likelihood estimation, as suggested by Fader et al. (2005). Note that a customer's behavioral parameters are a function of the estimation point (k). This consequently leads to changes in the transaction period, transaction frequency, and acquiring of new customers. Subsequently, the customer's behavioral parameters would also be the expected parameters of the customer segment's future behavior.

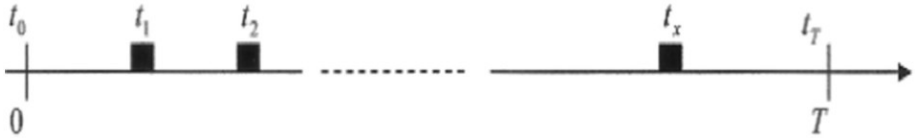

Fig. 1. A particular customer's previous purchase behavior for the entire period.

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3.1.2. Customer lifetime value of an individual customer

An individual customer's CLV estimation includes an expected transaction frequency, expected profitability, and discount rate.

$$Mean\ Profit(i,k) = \frac{\sum_{j=1}^{n} \text{Profit}(i,j)}{n} \tag{2}$$

[Eq. (2)] represents the average profit per transaction as the expected profitablity, which shows the total profit of customer i over his total purchase frequency (n: number of transactions for customer i). Finally, [Eq. (3)] represents the estimation model of CLV, embedding the discount rate (d) for customer i at estimation point (k) during time period t.

$$\begin{aligned} CLV(i,k,t) &= \left[\frac{E_i(Y_k(1))}{(1+d)} + \frac{E_i(Y_k(2)) - E_i(Y_k(1))}{(1+d)^2} + \ldots + \frac{E_i(Y_k(t)) - E_i(Y_k(t-1))}{(1+d)^t}\right] \times Mean\ Profit(i,k) \\ &= \left[\sum_{l=1}^{t} \frac{E_i(Y_k(l)) - E_i(Y_k(l-1))}{(1+d)^l}\right] \times Mean\ Profit(i,k), E_i(Y_k(0)) = 0 \end{aligned} \tag{3}$$

3.2. The relationship model between customer equity and firm performance

3.2.1. Estimation of customer equity

CE is composed of two parts: NCE and RCE. $NCE(k)$ is the summation of CLV for customers acquired during estimation period k and $RCE(k)$ is the summation of CLV for customers that were existing or acquired before period k. [Eq. (4)] represents CE at time k (N_k: total number of customers at period k; AN_k: total number of newly acquired customers at period k).

$$\begin{aligned} NCE(\mathrm{k}) &= \sum_{i=1}^{AN_k} CLV(i,k,t) \\ RCE(k) &= \sum_{i=1}^{N_k - AN_k} CLV(i,k,t) \\ CE(k) &= NCE(k) + RCE(k) \end{aligned} \tag{4}$$

[Table 1] shows NCE and RCE in detail. Suppose that firm acquires the customer in the first period ($k = 1$), the number of newly acquired customers is AN_1, and the total number of customers is also AN_1. The AN_1 of the first period is the number of the existing customers of the next estimation period ($k = 2$), and the number of period 2's newly acquired customers is AN_2. Therefore, $NCE(2)$ is estimated by AN_2, and $RCE(2)$ is estimated by AN_1 at the next estimation period ($k = 2$).

As defined by Hogan et al. (2002), CE comprises the CLV of both existing (retained) customers and newly acquired customers. Contrary to Gupta et al.'s (2004) work in which they directly estimate the number of future customers, the changing value for future customers by using time-series analysis, which covers the change of NCE, is indirectly considered in this study.

3.2.2. Dynamic effect of CE on firm profitability

First, a firm's profitability is regarded as the measure of its performance. With this assumption, an empirical model to estimate the effect of CE on firm profitability utilizes the distributed lag model (Koyck, 1954) that can effectively represent the long-term and carry-over characteristics of CE. In addition, to capture the dynamic effect of CE across market growth, a moving or sliding window regression technique (Mahajan, Bretschneider, & Bradford, 1980; Wildt, 1976) are employed. This technique allows the coefficients to vary over time. The following equations show the final empirical models.

$$\pi_k^{(w)} = \alpha_0^{(w)} + \lambda^{(w)}\pi_{k-l}^{(w-1)} + \sum_{l=0} \beta_l^{(w)} \cdot CE_{k-l}^{(w)} + \varepsilon_k^{(w)} \tag{5}$$

$$\pi_k^{(w)} = \alpha_0^{(w)} + \lambda^{(w)}\pi_{k-l}^{(w-1)} + \sum_{l=0} \left(\beta_l^{(w)} \cdot NCE_{k-l}^{(w)} + \gamma_l^{(w)} \cdot RCE_{k-l}^{(w)}\right) + \varepsilon_k^{(w)} \tag{6}$$

Table 1
Newly Acquired Customer Equity (NCE) and Retained Customer Equity (RCE).

k	Number of newly acquired customer	Total number of customer	NCE(k)	RCE(k)
1	AN_1	AN_1	$NCE(1) = \sum_{i=1}^{AN_1} CLV(i,1,t)$	
2	AN_2	$AN_1 + AN_2$	$NCE(2) = \sum_{i=1}^{AN_2} CLV(i,2,t)$	$RCE(2) = \sum_{i=1}^{AN_1} CLV(i,2,t)$
3	AN_3	$AN_1 + AN_2 + AN_3$	$NCE(3) = \sum_{i=1}^{AN_3} CLV(i,3,t)$	$RCE(3) = \sum_{i=1}^{AN_1+AN_2} CLV(i,3,t)$

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Table 2
Descriptive Statistics of the Data.

Item	Value
Duration	42 months
Total number of transaction frequency	107,640 units
Average sales per transaction	$148.34
Average profit per transaction	$6.68
Average profit rate per transaction	4.50%
Total number of membership customers	26,831 persons
Total number of transaction of enrolled customers(single day transaction)	31,300 units
Average sales per transaction of membership customer (single day transaction)	$318.69
Average profit per transaction of membership customer (single day transaction)	$18.44
Average profit rate per transaction of membership customer	5.79%
Average transaction frequency per a customer(single day transaction)	1.17 units
Average sales per customer	$371.77
Average profit per customer	$21.52
Average profit rate per customer	5.79%

In [Eqs. (5) and (6)], $\pi_k$denotes the firm's profit at time k; and CE_k,NCE_k, and RCE_kdenote CE, NCE, and RCE, respectively, at estimation time k. Specifically, [Eq. (5)] deals with total CE at estimation time k, but [Eq. (6)] handles two different kinds of CE: NCE and RCE. Each equation represents a specific window (w) out of all moving windows. In this study, a 12-month sliding window regression (window width = 12) is used and the period for each specific window (w) is 30. It generates enough sub-samples to estimate for each sliding window and enough fluctuation to investigate the trends of parameters. In addition, each equation has a lag parameter, which specifies or determines the lag (l) through the model fit.

$$\pi_k = \alpha_0 + \lambda\pi_{k-1} + \sum_{l=0}\left(\beta_l \cdot NCE_{k-1} + \gamma_l \cdot RCE_{k-1} + \delta_l \cdot GR_k \cdot NCE_{k-1} + \eta_l \cdot GR_k \cdot RCE_{k=1}\right) + \varepsilon_k \tag{7}$$

To examine the moderating effect of growth rate, the sliding window model [Eq. (6)] is transformed to the static model, which includes the interaction between the CE and the firm's growth rate. In [Eq. (7)], GR_k denotes the firm's growth rate at time k.

4. Analysis and results

4.1. Data

The study analyzes the transaction data of an online shopping mall in Korea. This shopping mall mainly deals with personal care goods and electronic products for the general consumer. The sample comprises only enrolled customers (26,831 customers) among more than 100,000 transactions, as the purchase history of only enrolled customers is available. The data covers most of the entire life cycle of an individual shopping mall. [Table 2] shows the descriptive statistics for the dataset. The data contains more than 100,000 transactions from 26,831 customers over 42 months. These transaction data include member ID, date and time of transaction, transaction amount, and transaction margin.

4.2. Behavioral parameter estimation.

42 ($t = 41$) monthly transaction data points are used to estimate the parameters using Fader et al.'s (2005) method.

Table 3
Results of Behavioral Parameter Estimation.

k	γ_k	α_k	a_k	b_k	$\frac{\gamma}{\alpha}(\lambda)$	$\frac{\alpha}{\gamma}$	$\frac{a}{a+b}(p)$	AN_t
1	0.037	6.081	1.295	0.512	0.006	163.462	0.717	1778
2	0.027	3.526	1.526	0.424	0.008	130.411	0.783	1235
3	0.023	2.652	1.118	0.265	0.009	117.441	0.808	821
4	0.021	2.221	1.236	0.278	0.009	107.684	0.817	474
5	0.019	1.927	1.248	0.288	0.010	101.680	0.813	241
6	0.018	1.702	1.427	0.308	0.011	94.883	0.822	234
7	0.017	1.597	1.169	0.257	0.011	94.658	0.820	321
8	0.018	1.606	1.274	0.289	0.011	91.472	0.815	659
9	0.018	1.648	1.226	0.313	0.011	90.700	0.797	999
10	0.018	1.603	1.303	0.337	0.011	90.392	0.795	960
11	0.018	1.662	1.295	0.363	0.011	93.835	0.781	1002
12	0.019	1.794	1.284	0.366	0.010	95.578	0.778	1384
13	0.019	1.782	1.248	0.350	0.011	91.749	0.781	1441
14	0.021	1.924	1.236	0.372	0.011	92.333	0.769	1605
15	0.021	1.945	1.208	0.376	0.011	93.029	0.763	1181
16	0.021	1.804	1.134	0.359	0.012	86.115	0.760	1194
17	0.021	1.653	1.254	0.392	0.013	78.400	0.762	1333
18	0.021	1.640	1.302	0.405	0.013	76.858	0.763	1480
19	0.021	1.502	1.279	0.392	0.014	71.293	0.766	1258
20	0.021	1.490	1.252	0.391	0.014	70.062	0.762	1075
21	0.021	1.456	1.225	0.381	0.014	68.966	0.763	902
22	0.021	1.419	1.248	0.396	0.015	68.197	0.759	659
23	0.020	1.377	1.255	0.399	0.015	67.362	0.759	734
24	0.021	1.408	1.256	0.405	0.015	67.732	0.756	1483
25	0.021	1.449	1.172	0.387	0.015	68.210	0.752	1421

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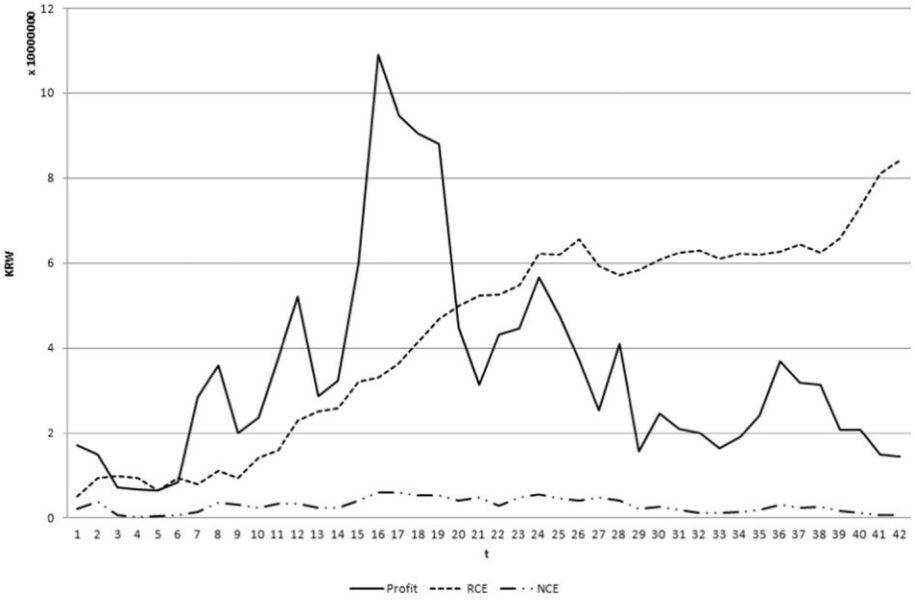

Fig. 2. Customer equity vs. firm profit over time.

[Table 3] shows a monthly estimation of behavioral parameters. In [Table 3], γ indicates the heterogeneity of purchase frequency (λ) among customers. Note that its small value refers to a large difference in purchase frequency (λ) among customers. In other words, it shows that there are customers who often purchase a product as well as those who seldom do so after their first purchase. As this value gets smaller with the passage of time, the heterogeneity of the purchase frequency (λ) becomes larger. The $\frac{\gamma}{a}(\lambda)$ is the expected value of the gamma distribution and represents the mean of customers' purchase frequency. The variable a means heterogeneity of the defection probability (p) between customers and it has a relatively larger value than γ. This indicates that the defection behavior of customers in this online shopping mall is somewhat similar, and means that homogeneity exists among customers' defection behavior.

In the second column from the right, p is the expected value of the beta distribution and it represents the mean of the defection probability. For example, almost 72% of newly acquired customers defect in the first period. Since the daily average purchase frequency (λ) gradually increases, the increasing trend of customers' repeat purchases is shown. The average defection rate (p) increases at the beginning but decreases after $k = 6$. This reflects that at the start of this business, the defection rate initially increases, but it later decreases as the business becomes stable. As can be seen in [Table 3], all the behavioral parameters have converging trends with time, since behavior may converge with the increased number of customers. Therefore, behavioral parameters become stable after the specific time ($k \geq 25$).

4.3. Customer equity and firm growth rate

[Fig. 2] shows a changing trend for estimated CE and actual firm profitability from the proposed model. As shown in [Fig. 2], RCE takes most of the share of total CE and shows an unstable and increasing

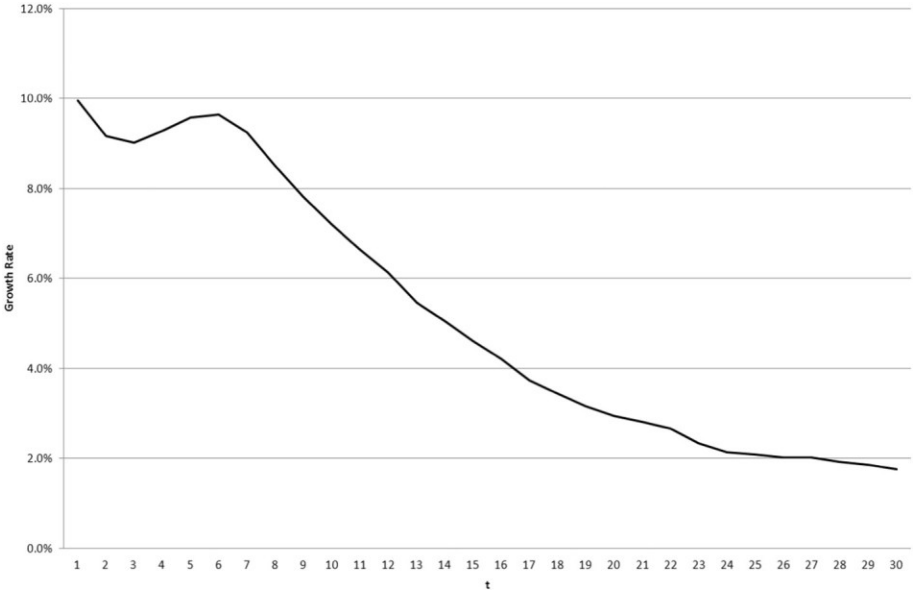

Fig. 3. Firm's annual growth rate.

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Table 4
Summary of Estimated Parameters over Time for the CE Model (Window or sample size = 12).

window (w)	log(CE)		Adj.R^2
1	0.951	(0.704)	0.530
2	0.794	(0.600)	0.547
3	0.733	(0.461)	0.638
4	0.866	(0.439)*	0.677
5	0.761	(0.433)	0.628
6	0.874	(0.371)**	0.601
7	0.871	(0.311)**	0.724
8	0.858	(0.397)*	0.585
9	−0.082	(0.521)	0.381
10	−0.088	(0.426)	0.260
11	−0.075	(0.435)	0.232
12	0.093	(0.430)	0.237
13	−0.438	(0.387)	0.391
14	−1.085	(0.377)**	0.582
15	−1.387	(0.582)**	0.626
16	−1.009	(0.777)	0.541
17	−0.871	(1.298)	0.247
18	−0.443	(1.437)	0.142
19	0.317	(1.481)	0.009
20	0.108	(1.766)	0.039
21	−0.295	(2.075)	0.155
22	2.043	(2.657)	0.287
23	5.186	(2.926)	0.397
24	4.806	(2.827)	0.267
25	4.490	(2.589)	0.160
26	5.000	(3.284)	0.053
27	2.868	(3.110)	0.101
28	1.468	(1.614)	0.100
29	−1.246	(0.908)	0.221
30	−0.905	(0.692)	0.434

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

trend, contrary to the stable trend of NCE, because of RCE's cumulative characteristics. In addition, a close relationship between profit and RCE in the early stage (up to 16 weeks) is observed. However, this relationship does not last after the early stage. These observations intuitively support the view that the effect of CE on firm profitability may vary over time.

In fact, large fluctuation because of various external environmental changes, including seasonality, exists. To avoid this large fluctuation, the annual growth rate is used. As you can see in [Fig. 3], the annual growth rate decreases after the first six periods. Based on the annual growth rate, the high-growth conditions and low-growth conditions of the firm's lifecycle are classified.

4.4. Dynamic trend for the impact of CE on firm profitability

First, this study analyzes the dynamic trend of the entire CE effect on firm profitability using [Eq. (5)]. The lags of the model (best lag = 1) using the adjusted R^2 and Bayesian Information Criterion (BIC) are determined. [Table 4] shows the summary of the estimated parameters over time. The adjusted R^2 ranges from 0.009 to 0.724. For only six periods out of 30 does the effect of CE significantly affect firm performance. Furthermore, at some periods ($k = 14, 15$) in the dataset, CE has a significant negative impact on firm profitability. According to the nature of CE and the arguments of previous research, CE should positively affect firm profitability. However, the result of dynamic analysis is not consistent with previous assumptions and the beliefs. At the same time, this result is consistent with recent research, in which the possibility of some negative impacts of CRM has been found (Maklan & Knox, 2009; Musalem & Joshi, 2009; Rigby, Reichheld, & Schefter, 2002; Ryals, 2005). [Fig. 4] also shows the dynamic characteristics of CE's effect on profit. Although most are not significant, the different trends of CE effects for the early stage (beginning periods) and later stage (ending periods) are shown. In the early stage (high firm growth rate), the effect of CE is rather smaller than that of CE in the later stage (low firm growth rate). Based on the high correlation of RCE and CE, this trend is similar to the prediction from the hypothesis.

Second, this study analyzes the dynamic trend for the respective effects of NCE and RCE on firm profitability using [Eq. (6)]. [Table 5] shows a summary of the estimated parameters (for NCE and RCE) over time. The adjusted R^2 ranges from 0.368 to 0.971. In all the periods, model fit is considerably increased. In addition, in most of the periods, the effect of NCE (in 27 periods) and RCE (in 17 periods) significantly affects firm performance. Therefore, after classifying the CE into NCE and RCE, the effect of CE is investigated more clearly with increased model fit. In other words, the total effect of CE in [Eq. (5)] may be attenuated and even converge with zero because of the different trends of the dynamic effects of NCE and RCE. Therefore, this model highlights the significant effects of RCE and effectively shows the roles of both NCE and RCE, as compared to the previous model. [Figs. 5 and 6] show the dynamic characteristics of the separate effects of CE (NCE and RCE) on profit. The effect of NCE on profit is eroded with a decrease in growth

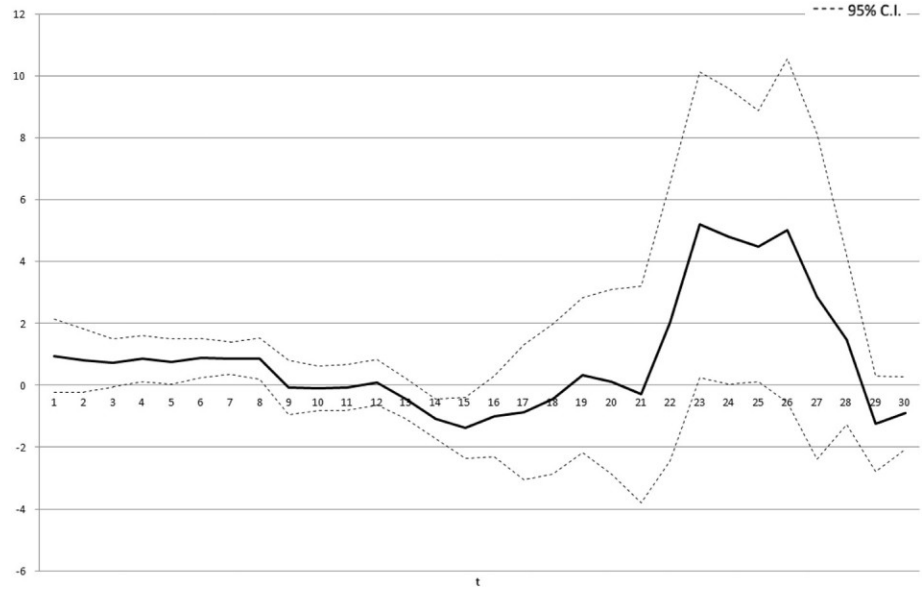

Fig. 4. The effects of CE on firm performance over time.

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Table 5
Summary of Sliding Window Parameters for the NCE and RCE model (Window or sample size = 12).

Window (w)	log(NCE)		log(RCE)		Adj.R^2
1	0.673	(0.201)***	0.716	(0.429)	0.749
2	0.905	(0.154)***	0.511	(0.248)*	0.892
3	0.842	(0.146)***	0.485	(0.195)**	0.911
4	0.917	(0.207)***	0.539	(0.230)**	0.879
5	1.157	(0.254)***	0.588	(0.214)**	0.871
6	1.173	(0.342)***	0.598	(0.224)**	0.800
7	1.294	(0.134)***	0.583	(0.086)***	0.971
8	1.436	(0.220)***	0.525	(0.153)***	0.919
9	1.255	(0.359)***	−0.527	(0.332)	0.728
10	1.023	(0.391)***	−0.202	(0.300)	0.557
11	1.101	(0.395)**	−0.460	(0.326)	0.567
12	1.106	(0.392)**	−0.492	(0.356)	0.568
13	0.837	(0.408)*	−0.630	(0.311)*	0.571
14	0.514	(0.433)	−0.930	(0.322)**	0.629
15	0.263	(0.496)	−1.193	(0.527)**	0.613
16	0.219	(0.515)	−0.981	(0.727)	0.508
17	0.867	(0.366)**	−1.288	(0.961)	0.530
18	0.827	(0.370)**	−1.227	(1.148)	0.426
19	0.715	(0.289)**	−0.406	(1.159)	0.368
20	0.653	(0.262)**	0.083	(1.326)	0.402
21	0.656	(0.225)**	−0.685	(1.440)	0.570
22	0.735	(0.196)***	1.360	(1.653)	0.693
23	0.756	(0.173)***	3.383	(1.927)	0.733
24	0.721	(0.164)***	3.251	(1.778)*	0.687
25	0.688	(0.148)***	3.517	(1.528)**	0.670
26	0.719	(0.161)***	4.240	(1.911)**	0.618
27	0.864	(0.131)***	3.262	(1.270)**	0.790
28	0.790	(0.145)***	2.640	(0.838)***	0.720
29	0.683	(0.106)***	1.234	(0.527)**	0.872
30	0.727	(0.116)***	0.943	(0.413)**	0.899

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.10$.

rate (compared to [Fig. 3]). In contrast, although some of the RCE effects on profit are insignificant, the direction of the effect is intensified with a decrease in growth rate, and most of the RCE effects in the later stage are significant and larger than those of the early stage. This means that the effect of RCE is not significant during the high-growth-rate period, when it has low-level impact on firm performance, but then gradually becomes larger and significantly positive with a decrease in growth rate.

To test for a significant difference between the effects of NCE and RCE depending on growth rate, whole periods are split into two groups. The first group comprises periods with a high growth rate (or the 10 highest-growth-rate periods). The second group comprises the periods with a low growth rate (or the 10 lowest-growth-rate periods). The effects of NCE and RCE of the two groups are compared using the t-test. [Table 6] shows the results of the t-test statistics. The effects of NCE in high-growth-rate periods are significantly greater than those in low-growth-rate periods (1.068 vs. 0.734, $p < 0.01$). In contrast, the effects of RCE in high-growth-rate periods are significantly greater than those in low-growth-rate periods (0.382 vs. 2.314, $p < 0.01$). In addition, the effects of NCE to those of RCE in the same periods are compared. In high-growth-rate periods, the effects of NCE are greater than those of RCE (1.068 vs. 0.382, $p < 0.01$), whereas the effects of NCE are smaller than those of RCE (0.734 vs. 2.314, $p < 0.01$) in low-growth-rate periods.

To examine the moderating role of growth rate on the effects of NCE and RCE, [Eq. (7)] was analyzed, and the results of parameter estimation are shown in [Table 7]. From [Table 7], the directions of moderating effects are consistent with this prediction. Specifically, the interaction effect (12.236, $p < 0.01$) between growth rate and NCE on firm profitability is significantly positive. This means that the effect of NCE on firm profitability can be higher when the growth rate is high. In contrast, the interaction effect (−10.219, $p < 0.05$) between growth rate and RCE on firm profitability is significantly negative. This means that the effect of RCE on firm profitability can be higher when the growth rate is low. Finally, the findings confirm the moderating effect of growth rate on NCE and RCE.

To summarize, the results of various analyses strongly support the hypothesis. Therefore, the effect of NCE on profit will be higher than that of RCE in the high-growth-rate condition and the effect of RCE on profit will be higher than that of NCE in the low-growth-rate condition. In other words, the effect of NCE and RCE on firm performance can be moderated by the firm's growth rate.

5. Discussion and limitation

Managing customers based on the CE metric has emerged as the most popular and effective way of doing business because of the ability to foster profitable CRM through appropriate marketing activities (Villanueva & Hanssens, 2007). In addition, demand for investigation of the relationship between CE and firm performance over time has increased. Findings confirm that CLV is an important metric for firms and that all firms are striving to grow CE over time. This can only happen when resources are allocated in order to retain current profitable

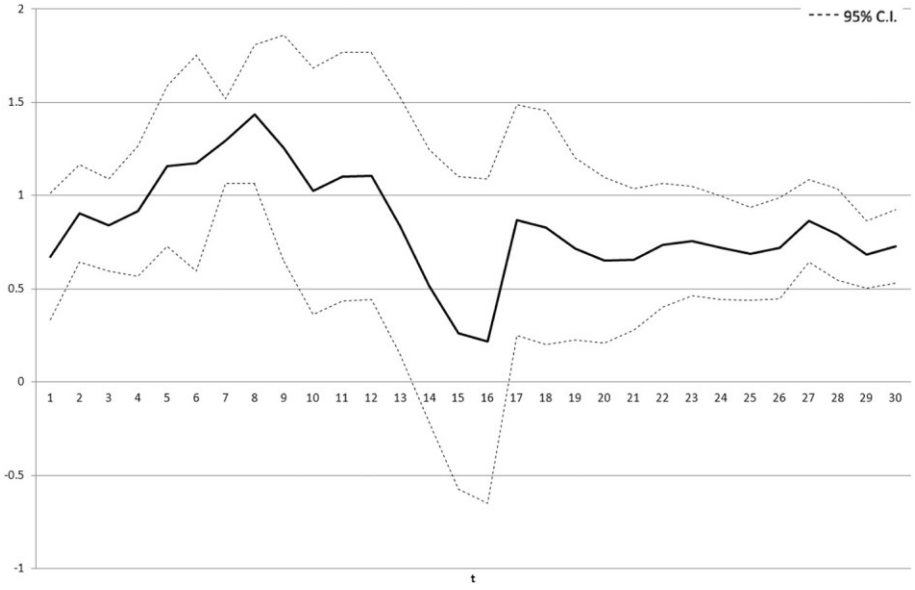

Fig. 5. The effects of NCE on firm performance.

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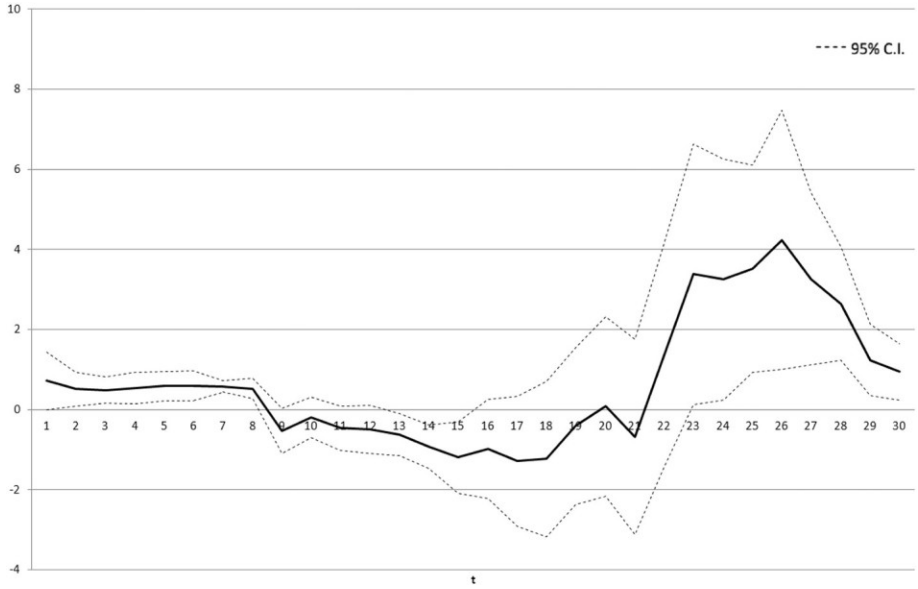

Fig. 6. The effects of RCE on firm performance.

customers and to acquire new profitable customers. Prior research has empirically shown that it is necessary to balance this acquisition and retention budget (Reinartz et al., 2005; Thomas, 2001).

This study contributes to the existing literature on the development effect of CE and addresses a strategy for marketing managers to determine what kind of customers to select for any given marketing campaign. Unlike most previous research, which suggests that retaining customers is the more important strategy for maintaining customer relationships and increasing firm profitability regardless of the firm's growth rate, this study suggests that in the early stage, the firm should focus more on acquisition strategy than on retention strategy. In other words, firms are benefited by differentiating lifetime value across each customer and thus applying differentiated marketing strategies relevant to each type of CE depending on the firm's growth rate. Consequently, firms can be discretionary in terms of which specific equity to focus on during the firm's lifecycle. Particularly, when the firm's growth rate is relatively high, the firm should allocate its resources to maximize the acquisition rate rather than retention rate, to enhance its profit. In this way, this study can address the proper strategy for a firm to adopt a suitable decision on which type of CE is most profitable at different stages of the firm. Therefore, the findigns suggest that marketing managers should implement strategies and tactics focused on increasing the acquisition rate when the firm's growth rate is high.

In addition, findings can explain why many firms expend more efforts to acquire new customers rather than invest in their existing customers. Depending on the firm's lifecycle stage, acquiring new customers may be a more effective tactic, even with a CRM strategy. For example, currently, a single firm can launch several new products or services with short product lifecycles, especially in the high-tech industry. In this case, the firm frequently experiences the beginning stage of the lifecycle for its new products or services. Therefore, it can acquire an expanded customer base rather than investing in its existing customers.

Finally, this research has identified directions for online firms, who can attempt to not only build a profitable customer relationship, but also focus on building a resource allocation strategy through the establishment of optimal customer segmentation based on the firm's growth. This study contributes to the existing literature by addressing the linkage between marketing metrics (CE) and firm performance using the two tenets of marketing—customer acquisition and customer retention.

This study has several limitations. First, even though both of these models assume independence between purchase frequency and churn rate, this assumption may be problematic in practice. Likewise, the current model unreasonably assumes the independence of monetary factors. Abe (2009) suggests an RFM model that considers all the correlations among the three factors of RFM. However, considering the fact that the objective of this research is not to develop a CLV model but to examine the relationship between CLV and firm profitability, suggesting a simple model with an independent assumption is more appropriate. The second is the consideration of the tentative future time *t*. CLV is a summation of the profit from a customer transaction up to the infinite future. However, an infinite future is not realistic. Therefore, defining a realistic and reasonable future time *t* is needed. In this study, a three-year period as an adequate time period, based on previous research, is defined (Kumar & Shah, 2009; Venkatesan & Kumar, 2004; Venkatesan, Kumar, & Bohling, 2007). Third, it related to the matter of distribution of customer profit. This study only uses the mean of an individual customer's purchase tendency, which reflects the tendency of an individual customer's purchase pattern, to estimate the individual customer's CLV. Fourth, even though several previous studies (Rust et al., 2004) did not consider the acquisition cost, its close consideration is necessary. In this study, extracting the acquisition cost from the

Table 6
Test of Significant Difference for the Effects of NCE and RCE Depending on Growth Rate.

	High Growth Rate Periods (10 periods)	Low Growth Rate Periods (10 periods)	t-value
Mean of effects of NCE	**1.068** (0.235)	0.734 (0.293)	4.344 ***
Mean of effects of RCE	0.382 (0.406)	**2.314** (0.432)	3.856 ***

***: p < 0.01, **: p < 0.05, *: p < 0.10.

Table 7
The Moderating Effect of Firm Growth Rate (Adj.R^2 = 0.843, 42 months).

Variables	Estimate	
(Intercept)	5.765	(4.624)
Lag	0.013	(0.150)
NCE	0.235	(0.125)*
RCE	0.431	(0.302)
Growth Rate*NCE	12.236	(3.220)***
Growth Rate*RCE	−10.219	(2.769)**

***: p < 0.01, **: p < 0.05, *: p < 0.10.

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available data due to the limitations related to revenue exists. Finally, since these results are based on a single and small-medium sized shopping mall, future research should consider other types of industries and environment factors to find an empirically generalizable relationship between CE and environment factors (Guercini, Ranfagni, & Runfola, 2014; Kim & Schellhase, 2015).

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