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How to reduce termination on freemium platforms—literature review and empirical analysis

Philipp Brüggemann¹ · Nina Lehmann-Zschunke¹

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Abstract

In light of increasing digitization and monetization, the freemium pricing model is being used more and more frequently. Against a backdrop of increasing competition and rising costs to attract new users, freemium platform providers need to know how to reduce termination rates. We analyze several influencing factors of termination rates using extensive data over a 5-year period from a freemium platform on sport and breeding horses. We find that shorter contract terms, increasing involvement, and increasing platform-specific content reduces termination rates. Furthermore, freemium providers should pay special attention to the interaction of video views and number of last logins. While both variables individually have no significant influence, the interaction effect positively affects termination rates. The higher both the number of video views and the number of last logins, the higher the termination rate. For freemium providers this finding leads to a dilemma. In short term (within a week), they do not know if a premium user has logged in for the last time and is willing to terminate. Still, this result is highly relevant for freemium providers. They should use our results to analyze last logins and video views ex post. In this way, they can learn about their customers' behavior and find out how to reduce the termination rate in the future.

Keywords Freemium · Online marketing · Online platform · Premium · Retention · Termination

Introduction and objectives

An increasing number of companies with digital business models, such as Deezer, Dropbox, or Spotify, are built on the freemium pricing concept (Wagner et al. 2014; Mäntymäki et al. 2020). In this pricing concept, customers can choose between a free basic and a paid premium service. The latter provides users with exclusive benefits (Liu et al. 2014). Here, revenues are generated mainly through the subscriptions of premium users and advertising (Osipov et al. 2015). However, according to Gu et al. (2018), continuous and plannable revenues are in particular generated by premium users. Accordingly, for freemium platform providers, it is key to retain their premium users. Otherwise, revenue can decrease dramatically when customers terminate their premium memberships. From freemium providers' perspective, it is crucial to analyze termination rates closely to ensure stable revenues and thus survival in the market. This is also

supported by current research, as Ross (2018) found a positive correlation between customer loyalty and monetization of freemium platforms.

Despite this increasing relevance of freemium pricing models in several sectors (e.g., education, data storage, data security, dating, gaming, newspaper, media streaming, messenger services, social networks) the reasons for terminating a premium membership are still unclear (Ahn et al. 2006; Wagner et al. 2014; Ascarza et al. 2018; Mäntymäki et al. 2020). On the one hand, the benefit of the subscription can omit, e.g., due to changing preferences or the end of a corresponding activity. In this case the platform providers have hardly any possibilities to influence the customers' decision. On the other hand, dissatisfaction with the service or with the platform itself can also be a reason for termination. In the latter scenario, providers can use customer retention strategies to observe and reduce customers' termination activities (Lee et al. 2011).

The purpose of this study is twofold. On the one hand, we aim to contribute to academic research on freemium platforms. We do this by looking at different theories to explain how premium users may behave in terms of termination. In addition, we conduct a comprehensive and systematic

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literature review to compile the status quo of freemium research on customer retention and prediction of churn. On the other hand, we aim to help providers of freemium platforms to analyze and increase customer loyalty. In particular, we investigate several factors that influence the termination rate. We provide meaningful new insights to freemium platform providers on how to identify and retain customers who are likely to terminate, e.g., through individual deals. As platform providers need to know how to analyze and reduce their termination rates and previous research is still limited, we formulate the following research question:

What factors can be leveraged to predict and prevent terminations on freemium platforms?

In the next section we provide the theoretical background for this study. We start with a theoretical background and provide an extensive literature review. We then dive into hypotheses development to theoretically derive influencing factors on termination rates. The empirical analysis section includes information on data and operationalization, descriptive statistics and regression results. Subsequently, we outline implications from our empirical findings. In conclusion, we point out a summary, some limitations and directions for future research.

Theoretical background and literature review

Theoretical background

To explain users' behavior on freemium platforms, we use the theory of confirmation/disconfirmation paradigm. This theory states that the evaluation of satisfaction, e.g., with a service, is the result of a comparison process. Thus, the expectation is compared with the actual product performance (Oliver 1980). This theory has been supported by empirical research (Ho et al. 1998; Wirtz and Bateson 1999; Yoon and Kim 2000; Bloemer and Dekker 2007). According to Oliver (1980), positive disconfirmation increases consumer satisfaction, while negative disconfirmation reduces satisfaction. Following the paradigm of Oliver (1980), the consumer will terminate a service, e.g., a premium membership, if the disconfirmation becomes negative. Furthermore, thanks to the extensive research on vendor lock-in theory (Arthur 1989), it is known that certain circumstances, such as cognitive switching costs on websites (Shih 2012) or switching costs between online platforms (Gao et al. 2014) can increase user retention. Beyond that, so-called network effects (Katz and Shapiro 1985; Haruvy and Prasad 1998; Farrell and Klemperer 2007) can also drive lock-in effects. In addition to these theories, the prospect theory by Kahneman and Tversky (1979) can be relevant to termination. The prospect theory states that individuals are more willing to

take risks when losses are imminent than when gains are possible. This theory has been used for research on freemium pricing models in different publications (e.g., Rietveld 2018; Niemand et al. 2019).

Transferred to platforms using the freemium pricing model this means that users will use the free version of the platform (or not use the platform at all) as long as the expectation of the paid version is higher than the performance. In other words, they will not pay for the premium version as long as their disconfirmation is negative. To evaluate the performance of the paid version, individuals can look at the benefits of a premium subscription. If the user's expectation is fulfilled by the premium offer (i.e. there is a positive disconfirmation), the user of the free version (or the interested individual who is not yet a user) may become a premium user. Considering the research on prospect theory and vendor lock-in theory, we believe that a premium user will only terminate when there is a clear negative disconfirmation. Interestingly, this may open up the possibility for freemium providers to forecast impending cancellations and take timely action. These remarks show the theoretical relevance of analyzing terminations for providers of business models based on the freemium pricing model. In addition to this theoretical background, we provide a literature review in the next section before we derive influencing factors regarding the termination in freemium business models.

Literature review

Over the past years, business models based on freemium pricing concepts have become more and more widespread (Harvard Business Review 2014). The term '*freemium*' is a combination of '*free*' and '*premium*' and describes two different versions of a product: a free version with a limited scope of use and a paid full version (Osipov et al. 2015). According to Gu et al. (2018), a freemium business model can only become successfully established if revenue is generated from the paid premium version in particular. As a result, increasing termination rates of premium users can jeopardize the entire business model. The churn of customers can be measured by the termination of a contract or, in some cases, by the decrease in demand for a company's products (Buckinx and Poel 2005). In the following text passages, we present and discuss the literature relevant to our work. We then delineate our research from prior research.

Based on the literature on freemium business models, we found three main types of publications in terms of research objectives: (1) *Implementation of free and premium strategies*; (2) *Conversion of basic users into premium users*; (3) *Customer retention and prediction of churn*. In the following sections, we will explain these three research types in more detail. Since we assign our work to the third research type



(*customer retention and prediction of churn*), we conduct an extensive literature review here. In doing so, we provide a profound differentiation of our research from previous literature.

(1) *Implementation of free and premium strategies*

There is a research body on how to implement a successful freemium pricing strategy. Here, differences in product quality between free and premium versions as well as pricing for premium versions are investigated in particular (e.g., Bourreau and Lethiais 2007; Hamari et al. 2017; Holm and Günzel-Jensen 2017; Hüttel et al. 2018; Niemand et al. 2019; Runge et al. 2022). With regard to pricing, for example, Runge et al. (2022) found that both conversions and revenues increase due to promotions. Moreover, the authors found no evidence of negative effects on quality due to price variation. An important term in the context of the pricing of freemium models is the zero-price effect (e.g., Niemand et al. 2015, 2019; Hüttel et al. 2018). This implies that the relationship between quality and price is inverted, so that the free offer has a higher perceived value. Other studies, such as Rietveld (2018), examine how freemium models compete with premium models. In terms of online games, Rietveld (2018) has shown that freemium games are played less and generate less revenue than premium games.

(2) *Conversion of basic users into premium users*

Another research strand of freemium models focusses on how basic users become premium users. Here, the authors of several publications investigate factors that influence the conversion of basic users into premium users (e.g., Pauwels and Weiss 2008; Li and Cheng 2014; Wagner et al. 2014; Mäntymäki and Islam 2015; Koch and Benlian 2017; Lee et al. 2017; Sifa et al. 2018; Hamari et al. 2020). Looking at free trial premium versions (“premium-first”), the conversion rate is significantly higher compared to starting with a free version (“free-first”). Moreover, this effect is stronger when the premium and free versions are similar (Koch and Benlian 2017). In addition, Hamari et al. (2020) found a negative relationship between enjoyment of the freemium service and the intention to purchase premium content. In contrast, the social value positively influences premium purchases. In addition, the authors find that the quality of the freemium service positively influences freemium usage. Interestingly, this does not seem to result in more premium purchases.

(3) *Customer retention and prediction of churn*

Another important area of research, to which we categorize our study, relates to the increase of customer retention and the prediction of churn. Table 1 provides a comprehensive literature review of publications relevant to this type of research. In addition, we have included the present study in Table 1 to classify and distinguish it from previous research. The table contains information on subject, data and method, key findings, as well as type of observed platform(s).

Our literature review reveals that there are numerous publications on freemium business models using data from gaming sector (e.g., Hadiji et al. 2014; Ross 2018; Ascarza et al. 2020; Hagen et al. 2021; Karmakar et al. 2022). These are usually free-to-play games, i.e. non-contractual, freemium models. Here, revenue is generated through in-game purchases or advertising. However, subscriptions usually play a minor role in these freemium games (Karmakar et al. 2022). Unfortunately, in these studies focusing on gaming, the investigations of churn or customer loyalty refer to free to play applications. For example, Rahmansyah and Hijrah Hati (2020) differentiate between continuance intention with respect to free use and purchase intention. As some of the factors they use are quite specific to online games, they cannot be readily applied to other areas. Another example is Karmakar et al. (2022). The authors consider player cooperation and player performance achieved at each level. A contractual freemium model was studied by Mäntymäki et al. (2020). They have shown that the values of users that are decisive for the upgrade intention are completely different from those that are decisive for the retention of a premium subscription. These differences clearly reveal the importance of examining in more detail factors that influence termination.

Hagen et al. (2021) also consider a freemium model with subscriptions, the premium version is purchased as an annual subscription. However, they take a different perspective than our study, looking at the impact of the premium version on engagement and retention, rather on factors that may lead to premium membership termination.

Based on the literature review presented above, we conclude that there is a gap in research looking at factors that influence the termination rate of premium users on online freemium platforms. Furthermore, there is a lack of empirical analyses over a long period of time with current and comprehensive data. Moreover, there are only a few publications that deal with other areas than gaming, e.g. streaming services or sports (see Table 1). We fill this research gap by identifying and empirically analyzing several factors influencing the termination of premium users of a freemium platform that provides information on (equestrian) sports.

Hypotheses development and research model

In the following sections, we derive the relevant hypotheses for this study based on the literature. To measure termination rates on freemium platforms, we consider different factors that have not yet been considered jointly in previous research. Furthermore, we differentiate from previous literature by looking at the relationship between influencing factors and termination rates per week. We deliberately do not aim at an individual level per user, but at a comprehensive measurement of the effect of



Table 1 Literature review on customer retention and prediction of churn

Author(s) and year	Subject	Data and method	Key findings	Type of platform(s)
Hadji et al. (2014)	Predicting player churn in freemium games	20 million play sessions from five different free-to-play games over a period of 5 months in 2013 Method: Experiment for the development of a machine learning approach to predict player churn (different classifiers, including Neural Networks, Logistic Regression, Naive Bayes and Decision Trees are compared)	Behavioral features like playtime, session time and inter-session time can be used when predicting churn in games The learned decision trees show that the number of sessions, the number of days, the average time between sessions and the current absence time are very important features to predict player churn	Gaming
Voigt and Hinz (2016)	Predicting Customers' Lifetime Value in freemium business models with initial purchase information	Payment data collected from three non-contractual freemium business models (two gaming companies and a dating platform). Combined, they have purchases from about 57,000 paying customers Method: Negative binomial regression, ordinary least squares regression and logistic regression	Customers have higher future lifetime values if they make a purchase early after registration, spend a significant amount on their initial purchase, and use credit cards to purchase credits The average revenue per purchase increases with the number of purchases a customer makes	Gaming and Dating
Ross (2018)	Comparison of four retention measures (daily, timed, full, and rolling retention) and relationship between customer retention and monetization in freemium games	51 freemium mobile video games with 5.7 million individual installs, 300 million user sessions, and 46.8 million unique daily active users (data from 2016/01/17 to 2016/02/06) Method: Correlation analysis	Timed retention is the strongest predictor of monetization The study shows a positive relationship between customer retention and future monetization	Gaming
Banerjee et al. (2020)	Predicting user Activity, engagement, and churn in freemium games	Player level gaming information from 38,860 gamers over a period of 60 days in a mobile app game Method: Development of a constrained extremely zero inflated joint modeling framework for simultaneous analysis of player activity, engagement, and churns; it is also used to segment players based on their churn rates	Chances for user activity increase on weekends and through in-app purchases; chances decrease if there was no log-in at the previous day The number of additional battles played, level progression, virtual in-app currency spent and earned affect the probability of a positive engagement at later points in time Gamers who do not visit the game often and who spend more of their virtual currencies have a high probability of dropping out at later times Promotions can help to reduce the odds of dropouts validating their usage as retention schemes	Gaming

Table 1 (continued)

Author(s) and year	Subject	Data and method	Key findings	Type of platform(s)
Ascarza et al. (2020)	Customer retention and monetization in freemium games	Field Experiment with a free-to-play game from 2014/06/11 until 2014/08/03; 329,999 users and 79 million gaming sessions are considered Method: Ordinary least squares regression	Reducing game difficulty among customers at risk of churning increases engagement, retention and customer spending for premium services The study shows heterogeneity in the effect of reducing game difficulty, where customers who are more prone to make progress in the game exhibit stronger effects Customers who have already spent money on the game show the strongest effect on in-app purchases	Gaming
Mäntymäki et al. (2020)	Differences between basic and premium users in terms of different values that influence basic users' decision to upgrade and premium users' decision to retain their subscriptions	Survey data from 436 users of a leading online music service (Spotify) Method: Structural equation model	The user values that drive upgrade intent are completely different from those that drive premium subscription retention The study shows that enjoyment and price value are the only predictors of the intention to upgrade The intention to retain the premium subscription is determined by the discovery of new content and ubiquity, enjoyment and price value have no effect and social connectivity has a negative effect	Media Streaming
Rahmansyah and Hijrah Hati (2020)	Influence of customer engagement experiences between satisfaction and loyalty relationships on freemium business model; loyalty intention involves the two dimensions continuance intention and purchase intention	Survey data of 274 freemium app users Method: Structural equation model	Satisfaction has a positive effect on the continuance intention and a negative influence on purchase intention The greatest influence in moderating satisfaction with purchase intention has utilitarian value Social facilitation is the only dimension of customer engagement experiences that moderates continuance intention and purchase intention	Gaming
Hagen et al. (2021)	Impact of premium version adoption on user engagement and retention in a freemium business model	Daily activity of 12,000 users of a freemium mobile fitness application over several months Method: Gaussian copula approach	Lagged tracking behavior increases user engagement and retention Premium membership improves user engagement and retention Premium version adoption is a pivotal factor for the customer relationship management	Sports



Table 1 (continued)

Author(s) and year	Subject	Data and method	Key findings	Type of platform(s)
Karmakar et al. 2022	Development of a joint modeling framework to predict retention in freemium games by jointly modeling players' motivation, progression and churn	Individual level-wise characteristics, social collaboration and game activities of 15,000 players in an online action role-playing game over a 3 months timespan Method: Generalized linear mixed model framework; the parameters of the joint model are estimated using a Hamiltonian Monte Carlo algorithm	Players with a male character have a greater probability of dropout than female characters Users with higher engagement values are more likely to have higher achievement and more collaboration Collaboration is negatively associated with dropout; players with high achievement have a lower chance of dropout When different levels of promotion are offered to improve collaboration, freemium models can increase customer retention and revenue	Gaming
Brüggemann and Lehmann-Zschunke (2023) (this study)	Empirical analysis of factors influencing the termination rate on freemium platforms	Aggregated analysis per month Unique data set from 2016 to 2021 with rich data on user- and platform-specific information of a freemium platform on sport and breeding horses Method: Linear regression with interaction effect	Shorter contract terms, increasing involvement, and increasing platform-specific content reduce the termination rate significantly There is an interaction effect between video views and number of last logins. While both variables individually do not have the expected impact, the interaction effect positively affect the termination rate. The higher both the number of video views and the number of last logins, the higher the termination rate	Sports

individual influencing factors that can be used to monitor and determine termination rates of the freemium platform. For this reason, we derive hypotheses in the following text passages with a view to the effect of influencing factors on the termination rate per week.

For the customer's decision to continue a premium subscription or to subscribe to a premium version for the first time, the expected risk is important, similar to purchase decisions for physical goods (see on the relationship between expected risk and purchase decisions, e.g., Kaplan et al. 1974; Ariffin et al. 2018). With respect to the paid premium version of a freemium platform, we expect that users' expected risk increases the longer the length of the subscription, since the total amount to be paid is generally higher even with, for example, lower monthly contributions. Various studies on subscriptions have already proven that the expected risk has a strong negative influence on the attitude toward an offer and that users expect flexibility (e.g., Bischof et al. 2020; Descloux and Rumo 2020). Against this backdrop, we expect that a short-term subscription, compared to a long-term subscription, implies a higher flexibility concerning the termination as well as a lower risk. Thus:

H1 The higher the share of short-term subscriptions in a week, the lower the termination rate in this week.

Another possible influencing factor in the context of freemium business models is users' involvement (Gainsbury et al. 2016). The involvement of a user can serve as an indicator of personal interest and the perceived relevance of the content of the premium version (Niemand et al. 2015). In previous research, a positive influence of users' involvement has been identified, for example, regarding satisfaction with the premium offering (McDonald 2010). According to Oestreicher-Singer and Lior Zalmanson (2013), user's willingness to pay for premium services is strongly positive related to the level of participation in the community. Consequently, we expect, the higher user's participation, the higher her or his involvement, the lower the probability of termination. Moreover, Karmakar et al. (2022) emphasize the importance of user engagement for customer loyalty in freemium models. The authors conclude that, in line with user involvement, user engagement is also an indicator of personal interest in the content of the premium version. In online games, Karmakar et al. (2022) found that changes in players' engagement are highly significant in predicting impending terminations. Thus, we expect a positive correlation between the share of premium users with high involvement and the termination rate. Thus:

H2 The higher the share of premium users with high involvement in a week, the lower the termination rate in this week.

An important incentive for the paid use of a premium version is the content available in contrast to the free version (Kim and Kim 2020; Mäntymäki et al. 2020). Wagner et al. (2014) found that a strong difference between the freely available content and the premium content increases the probability of conversions to premium memberships. Consequently, we expect the more new content is provided by the online platform provider the lower the termination rates. Thus:

H3 The more new content is provided on the platform in a week, the lower the termination rate in this week.

To benefit from a premium membership, users must actively use the content of the online platform. Previous literature analyzed the relevance of users' activity, for example, in the context of online freemium games and music platforms (Yu et al. 2017; Bapna et al. 2018; Banerjee et al. 2020). For instance, Bapna et al. (2018) found that users who converted to a premium membership of a music platform were significantly more active. In addition, Rothmeier et al. (2021) point out the importance of activity in online games in predicting user termination. They conclude that the more active and motivated users are, the less likely they are to terminate. With this in mind, we include both the number of profile visits and the number of videos views as two relevant indicators of premium user activity. Thus:

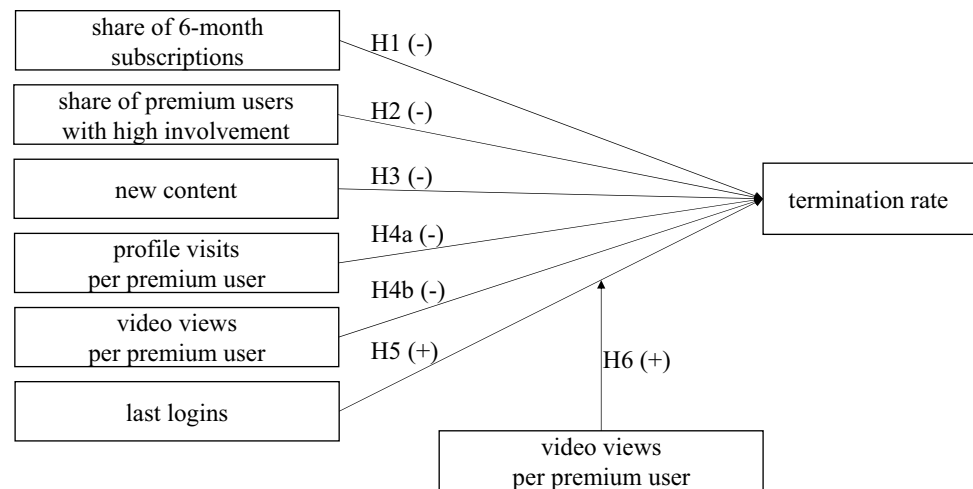
H4a The higher the number of visited profiles per premium user in a week, the lower the termination rate in this week.

H4b The higher the number of video views per premium user in a week, the lower the termination rate in this week.

Complementing the hypotheses about user activity, we expect that when the premium membership benefit has expired, customers will no longer log in, which increases the likelihood of termination. In line with this, Castro and Tsuzuki (2015) pointed out the high relevance of login behavior in predicting churn. In a similar framework, Rothmeier et al. (2021) also use the number of users' logins for churn prediction. Consequently, we expect a positive relationship between the termination rate and the number of last logins per premium users in this week. We therefore expect the termination rate to increase in a week in which more households have logged in for the last time. It should be noted that when a household logs in for the last time, this does not mean that it also terminates directly. Furthermore,



Fig. 1 Research model



it should be pointed out that the last login can, of course, only be measured ex-post. Nevertheless, we are interested in this relationship because such ex-post data can also help to reduce future termination rates. Thus:

H5 The higher the share of last logins in relation to all premium users in a week, the higher the termination rate in this week.

While we expect the number of video views per premium user to have a negative effect on the termination rate and the share of last logins in a week to have a positive effect, we additionally consider the interaction between these two influencing factors. From the user's perspective, it is reasonable to expect that premium users who want to terminate will make more use of their premium benefits (watching videos), log in for the last time, and then terminate. The relevance of interaction effects in customer loyalty for premium offers has been proven by Hagen et al. (2021). Against this background, we complement this insight and postulate an interaction effect between video views and last logins, specifically for termination rates on freemium platforms. We expect that the advantages of the premium membership will be used more intensively before a termination occurs. Some videos may be watched again during the last login, since this is no longer possible after termination. Thus, we expect an interaction effect between the number of video views per premium user and the share of last logins. The higher both the number of video views and the share of last logins in a week, the higher the termination rate in this week (see Fig. 1). Thus:

H6 The higher the number of video views per premium user and the share of last logins in a week, the higher the termination rate in this week.

Based on these literature-based hypotheses we came up with the following research model (see Fig. 1).

To test the hypotheses, we decided to use an empirical approach for several reasons. First, the use of a regression analysis allows us to quantitatively measure relationships between the selected influencing factors and the termination rate. Second, this empirical method allows us to analyze and compare the results of influencing factors simultaneously. Third, our analysis is based on very actual data from the field. Thus, we can provide highly actual and relevant results based on comprehensive data. Fourth, the empirical analysis using a regression allows us to consider interaction effects between different influencing factors.

Empirical analysis

Data and operationalization

The object of this study is an online platform providing users with various information on horses for sport and breeding. This online platform belongs to a publishing house that operates throughout Europe. Information includes pedigrees of horses, results of horse shows and videos of sport and breeding events. The platform is based on a freemium concept. While there is a free basic version, only premium users get full access to videos and tournament results. The underlying data of this online platform was collected from January 2016 to March 2021. In this period, we excluded data from two weeks because in those weeks the termination rate was driven by a price increase in the previous week.

For all variables, we aggregate the data to calendar weeks. This allows us to fundamentally regress the impact of the independent variables (e.g., new content, profile visits, and last logins in a week) on the termination rate. We also calculate some of the variables on a per-user basis to avoid bias from trends in our data, because over the entire observation period, the number of premium users is steadily increasing.

Table 2 provides an overview of the operationalization of both the dependent variable (*d*) and the independent variables (*i*).



Table 2 Variables and operationalization

Variable	Formula	Description
<i>Termination rate_w</i> (<i>d</i>)	$\frac{\text{number of termination}_w}{\text{number of premium users}_w}$	Number of terminations in relation to all premium users per week
<i>Share of 6-month subscription</i> (<i>i</i>)	$\frac{\text{number of premium users with a 6-month contract}_w}{\text{number of all premium users}_w}$	Share of premium memberships with a contract term of 6 months versus a contract term of 12 months per week
<i>Share of premium users with high involvement_w</i> (<i>i</i>)	$\frac{\text{number of premium users with a assignment to a horse}_w}{\text{number of all premium users}_w}$	Share of premium users per week who are directly assigned to a horse (owner, rider, breeder), so that a high level of involvement can be assumed
<i>New content_w</i> (<i>i</i>)	$\text{number of tournament results}_w$	Tournament results entered by the platform provider per week. These are only available for premium users
<i>Profile visits per premium user_w</i> (<i>i</i>)	$\frac{\text{number of visited horse profiles}_w}{\text{number of all premium users}_w}$	Number of visited horse profiles per premium user per week
<i>Video views per premium user_w</i>	$\frac{\text{number of videos viewed}_w}{\text{number of all premium users}_w}$	Number of videos viewed per premium user per week
<i>Last logins_w</i> (<i>i</i>)	$\frac{\text{number of last logins}_w}{\text{number of all premium users}_w}$	Number of last logins in relation to all premium users per week
<i>Video views per premium user X last logins_w</i> (<i>i</i>)	$\text{video views per premium user}_w * \text{last logins}_w$	Interaction between video views per premium user and last logins

w = week; d = dependent variable; i = independent variable

We calculate the *termination rates* by dividing the number of terminations to all premium users per week. To obtain the *share of 6-month subscription*, we divide the number of 6-month premium subscriptions by all premium subscriptions (6-month and 12-month) per week. For users who are directly assigned to a horse (owner, rider, breeder), we presume a high involvement. The *share of premium users with high involvement* is therefore the number of premium users with an assignment to a horse divided by all premium users. The variable *new content* represents tournament results entered by the platform provider per week. These results are only available for premium users. Profile views and video views are measures per premium users. Thus, we divide the number of *profile views* respectively *video views per premium user* by the number of all premium users per week. We calculate the variable *last logins* by dividing the number of last logins in a week by all premium users in that week. By multiplying the two variables video views per premium user and last logins we obtain the interaction effect (*video views per premium user X last logins*) per week. Finally, we formulate the following regression equation:

with γ_k = regression coefficients, ε_1 = error term, w = week.

Findings

Descriptive statistics

Figure 2 shows the development of user numbers for the free basic version and the paid premium version of the exemplary freemium platform. Over the entire observation period from 2016 to 2021, both the user numbers for the free basic version and those for the premium version are rising continuously. However, if we look at the percentage increase, we can clearly see that this percentage increase is continuously falling. This development may be due to (partial) market saturation combined with increasing competition. In saturated and highly competitive markets, customer retention and especially churn management are of great relevance (Jeng and Bailey 2012; Premkumar and Rajan 2013). Therefore, the analysis of how to affect termination rates is essential to retain customers in the long run.

$$\begin{aligned}
 \text{termination rate}_w = & \gamma_1 + \text{share of 6-month subscription}_w * \gamma_2 \\
 & + \text{share of premium users with high involvement}_w * \gamma_3 \\
 & + \text{new content}_w * \gamma_4 + \text{profile visits per premium user}_w * \gamma_5 \\
 & + \text{video views per premium user}_w * \gamma_6 \\
 & + \text{last logins}_w * \gamma_7 \\
 & + \text{video views per premium user}_w * \text{last logins}_w * \gamma_8 + \varepsilon_1
 \end{aligned}$$



Fig. 2 Growth of premium and basic version users from 2016 to 2021

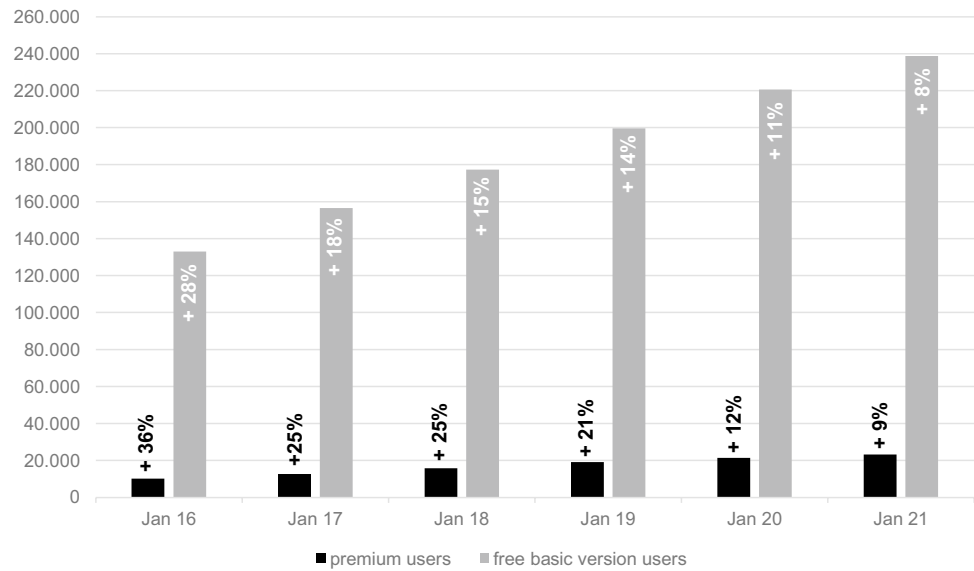


Table 3 contains the descriptive statistics for all variables we used. The variable *termination rate* varies between the observed weeks from 0.01 to 0.36%. Interestingly, most users have signed a long-term contract (12 months). The *share of 6-month subscriptions* is 21.42% on average. The values vary between 19.18 and 22.40%. On average, almost half of the users have a high involvement (49.47%). During the observation period, the *share of premium users with high involvement* varies between 44.11 and 56.32%. The variable *new content* varies between 0 and 41,075. On average, 15,097 new tournament *results* were entered by the platform provider per week. Values vary by an average of 11,626 per week. On average, 2.32 *profiles were visited per premium user* in one week. These values range from 0.22 to 2.99 profile visits per premium user per week. On average, 1.65 *videos were viewed per premium user* in one week. The lowest value of this variable is 0.14, the highest value is 2.69. The number of *last logins* per premium user varies between 0.00 and 0.07. On average, 0.38% of premium users log in for the last time per week. For the interaction effect,

the multiplication of the two variables results in lower values between 0.00 and 0.07 with a mean value of 0.06.

Linear regression

We perform the empirical analysis with a linear regression analysis using Mplus6. Since we cannot exclude a violation of the assumption of normal distribution in some cases, we use the robust maximum likelihood estimation (Satorra 2000). Before we detail our empirical results, we check the goodness-of-fit parameters. The cutoff value of 10 for the VIF required in the literature is not exceeded for any variable (Wooldridge 2013; Hair et al. 2014). The VIF values range from 2.090 to 8.773. The Durban Watson value of 1.191 does not indicate any autocorrelation. The coefficient of determinations (R^2) of 0.3417 provides an acceptable explanation of the dependent variable. We summarize our empirical results in Table 4. We elaborate on these results in detail below.

As expected, there is a negative relationship between the share of 6-month subscriptions and the termination rate (β :

Table 3 Descriptive Statistics

Variable	<i>n</i>	Min	Max	Mean	SD
<i>Termination rate (d)</i>	274	0.0001	0.0036	0.0020	0.0005
<i>Share of 6-month subscription (i)</i>	274	0.1918	0.2240	0.2142	0.0075
<i>Share of premium users with high involvement (i)</i>	274	0.4411	0.5632	0.4947	0.0353
<i>New content (i)</i>	274	0.0000	41,075	15,097	11,626
<i>Profile visits per premium user (i)</i>	274	0.2164	2.9864	2.3163	0.4342
<i>Video views per premium user (i)</i>	274	0.1394	2.6944	1.6543	0.3804
<i>Last logins (i)</i>	274	0.0000	0.0653	0.0038	0.0064
<i>Last logins X video views per premium user (i)</i>	274	0.0000	0.0688	0.0060	0.0084

(*d*) = dependent variable; (*i*) = independent variable; *n* = observation period (weeks)



Table 4 Empirical results

Independent variable	Hypotheses	Std. path estimate β	p value	Hypotheses review
Share of 6-month subscription	H1 (–)	– 0.260	<0.001	Yes
Share of premium users with high involvement	H2 (–)	– 0.452	<0.001	Yes
New content	H3 (–)	– 0.301	<0.001	Yes
Profile visits per premium user	H4a (–)	0.797	<0.001	No
Video views per premium user	H4b (–)	– 0.142	0.215	No
Last logins	H5 (+)	– 0.096	0.180	No
Video views per premium user $\times$ last logins	H6 (+)	0.279	0.020	Yes

– 0.260; $p < 0.001$). Consequently, *hypothesis H1 is supported*. Since higher shares of premium users with high level of involvement leads to a reduction in the termination rate (β : – 0.452; $p < 0.001$), *our findings support hypothesis H2*. The more new content is available for premium users, the lower the termination rate (β : – 0.301; $p < 0.001$). *Hypothesis H3 is supported*. Contrary to our expectations, a high number of visited profiles leads to a significant increase in the termination rate (β : 0.797; $p < 0.001$). Consequently, *we have to reject hypothesis H4a*. The empirical results do not provide a significant relationship between video views per premium user and the termination rate (β : – 0.142; $p = 0.215$). Since this effect is negative and not significant, *we must reject hypothesis H4b*. As last logins show no significant effect on the termination rate per week (β : – 0.096; $p = 0.180$), *we have to reject hypothesis H5*. Our empirical analysis indicates that the interaction effect of video views per premium user and last logins per week results in a significant increase in the termination rate (β : 0.279; $p = 0.020$). Consequently, there is an interaction effect between these two variables, *which supports hypothesis H6*.

Implications

Managerial implications

With this research, we provide numerous valuable managerial implications, which are elaborated below. The fact that a shorter contract duration leads to lower termination rates is a valuable insight for freemium providers. Interestingly, the descriptive statistics of this analysis surprisingly show that most customers have signed a long-term contract (12 months). As there might be a huge potential to reduce termination rates by providing more short contract durations, the specific company should take a critical look at this. For all other providers, this also means that they should review their customers' contract terms in depth. Our results highlight that more user flexibility can prevent terminations.

The fact that higher user involvement lowers the termination rate is in line with our expectations. Consequently, freemium providers should take care to give consumers various opportunities to build up a high level of involvement with the platform. This could be realized, for example, by assigning users to one of various groups, as in the exemplary freemium platform (owner, breeder, rider). Furthermore, integration through individualization of users' accounts is even conceivable, e.g., through an individual avatar. In view of recent developments in the field of non-fungible tokens (NFT) and Metaverse (Wang et al. 2021), it may also be imaginable to purchase individual digital add-on products that increase involvement, retain customers and reduce termination rates.

In addition, it is obligatory that the content must be kept updated. If the content provided on the platform is not constantly updated and supplemented, termination rates increase. Even though this result was to be expected, with our findings we provide empirical evidence of this expectation. Freemium platform operators should take this result seriously and also focus on the topicality of the information available on the platform.

A higher number of profile visits per premium users surprisingly leads to a higher termination rate in that week. A possible explanation for this unexpected result is that profiles can be visited also without a premium membership. Even though not all information is visible, some premium users may find the limited information sufficient and therefore no longer need the subscription. The platform provider should pay particular attention to highlighting the advantages of the premium version. In addition, further exclusive content may be helpful to ensure that increasing activity among premium users does not lead to a further increase in termination rates.

Surprisingly, there is no significant relationship between the number of video views and the termination rate. For the platform providers, this means that video views alone cannot be used as an indicator for terminations. We suspect that at least two effects might play a role here. On the one hand, it may be that the more videos users watch, the less likely they are to terminate. On the other hand, it could also be that



some users watch a lot of videos because they are looking for specific information or want to make a purchase (e.g., buying a horse). As soon as the reason for this intensive search is no longer present, this premium user may terminate. Both effects together may explain the non-significant relationship we found here. However, this relationship needs to be investigated further.

Surprisingly, we find no significant relationship between last logins and termination rates. For platform operators, this means that the ex-post analysis of last logins is not suitable to predict terminations. Interestingly, this means that consumers do not log in for the last time and terminate in the same week. This result is highly relevant for platform operators, as it shows that they have time to anticipate the threat of termination. However, to do so, the platform providers need to identify impending terminations. The analysis of joint effects of different influencing factors is one way to do this.

As indicated above, we also include an interaction effect in our empirical analysis. The significant interaction effect between video views per user and last logins provides new insights for freemium platform providers to indicate terminations. Our results show that the more videos within a week and last logins take place the higher the termination rate in that week. As mentioned above, the last login can only be identified ex-post, i.e. when the cancellation has already taken place. Nevertheless, the insights gained here can be used to analyze users' behavior on freemium platforms to better predict terminations. For instance, changes in user activity combined with changes in user login behavior may be used to identify impending terminations. These users can then be confronted with the benefits of a premium membership or with specific offers.

Although our findings are based on extensive data from an exemplary platform, we expect that the results are highly transferable. The literature-based variables on termination rates are relevant for many freemium business models. For example, in education, data storage, data security, dating, gaming, newspapers, media streaming, messenger services, and social networks, we expect that contract duration, users' involvement, and content can significantly affect termination rates. Furthermore, the interaction effect we identified may also be transferred to other freemium platforms. We expect that the simultaneous occurrence of increased usage of premium services (e.g., video views in our empirical study) and ex-post measured last logins may indicate impending termination for the freemium business models mentioned above. We therefore recommend that all providers using a freemium pricing model analyze consumers' usage and last logins together with a view to terminations. In this way, they can learn to identify customers at risk of termination at an early stage and take appropriate action.

Theoretical implications

We contribute to the previous literature by providing several new theoretical implications on the factors influencing termination rates on freemium platforms. Based on the confirmation/disconfirmation theory, the lock-in effect and the prospect theory, we explain how termination on freemium platforms comes about. Moreover, we provide a comprehensive literature review of the current state of research on customer retention and prediction of churn. We investigate that previous research on the freemium pricing model has often been analyzed using the example of gaming platforms (e.g., Banerjee et al. 2020; Ascarza et al. 2020; Rahmansyah and Hijrah Hati 2020; Karmakar et al. 2022). Consequently, we use empirical data that do not come from the field of gaming. Furthermore, we find that the factors influencing termination rates have hardly been researched so far. Ross (2018) analyzes different retention measurements, but does not consider a set of influencing factors simultaneously. The fact that he implements isolated correlation analyses additionally limits the findings. In this study, we distinguish from previous literature by examining several influencing factors as well as an interaction effect using a linear regression. Furthermore, we found no research considering an interaction effect between usage of premium advantages and last logins.

As a result of these observations, we shed light on several new aspects of the freemium pricing model. First, we literature-based derive a set of influencing factors and analyze them jointly. Second, we analyze termination rates per week to show how changes in the influencing factors affect the overall platforms' termination rates of premium users. Third, we analyze ex-post last logins of premium users. Based on this, it is now possible to analyze if/how the last login in an observed week affect the termination rate. Fourth, we contribute to the existing freemium literature by investigating an interaction effect between video views and last logins. We find that the interaction between video views and last login significantly increases termination rates.

Conclusion

Summary

With this study, we provide valuable and new insights for both researchers and practitioners in terms of customers' retention on freemium platforms. Our literature-based research model enables us to better understand how to influence termination rates on freemium platforms. Moreover, we found an interaction effect between video views and last logins. Such an interaction effect has not been investigated in previous research on freemium pricing models.



For practitioners, our study provides several implications. First, freemium providers should take advantage of the fact that a shorter contract term leads to a fundamentally lower termination rate. Second, providers should try to increase customers' involvement through specific offers. Thus, the churn rate can be decreased. Third, platform-specific content can help reduce termination rates, too. Freemium providers should ensure that the provided content is highly up-to-date. Fourth, special attention should be paid to the joint effect of number of video views (only possible for premium users) and last logins of premium users. Both variables show neither the postulated sign in terms of the standardized path coefficient nor significant results. Indeed, it is the interaction of the two factors that leads to an increase in termination rate. On one hand, this finding leads to a dilemma, since they do not know in the short term (within a week) whether a premium user has logged in for the last time and is therefore at high risk of cancelation or will later log in again. On the other hand, freemium providers can use these new insights to analyze last logins as well as video views in the long run. Thus, they can observe customers' behavior ex-post to learn how to reduce future termination rates.

Limitations and further research

Although our findings provide new insights into selected factors that influence premium users' termination rates, the study has some limitations. An individual forecast of the termination probability per premium user is not possible on the basis of the aggregated data. In further research, this individual user level should be considered in detail, especially with the aim of generating individual termination predictions. Still, the empirical results are based on data from a single freemium platform. While generalizability of the data is obvious, it should nevertheless be verified with further data—also from other sectors. Other influencing factors, such as the remaining contract term, could be added in further investigations. Regarding the dilemma in the interaction effect between the video views and last logins, there is need for further research. The login behavior of premium users over the past few weeks could be considered to more accurately predict termination rates continually. If a premium user logs in regularly, but this regularity then drops sharply and his activity in terms of video views increases at the same time, this may be a strong and precise indicator of an impending termination.

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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