FREE(MIUM) STRATEGIES FOR DIGITAL GOODS

Kevin J Boudreau
Northeastern University & NBER (kevin@neu.edu)

Lars Bo Jeppesen
Copenhagen Business School (lbj.si@cbs.dk)

Milan Miric*
University of Southern California (mmiric@marshall.usc.edu)

Abstract

Freemium strategies (offering both a free and paid version) are a commonly used approach to sell digital goods. Academic research into freemium strategies is distributed across disciplines, and each study typically focuses on a single type of freemium strategy within a specific context. This chapter provides a review of the literature on freemium strategies, highlighting the central insights across these studies. The goal of this review is to provide a resource that researchers can use to gain an overview of research into this topic. We then discuss areas where there are opportunities for further exploration, and where the anecdotes that are often used to discuss freemium strategies and the reality of the academic literature do not align. We conclude by highlighting areas for future research into this domain.

1. Introduction

The term "Freemium" is often used to describe a specific pricing and product strategy when multiple versions of a product are being offered: A superior version sold for a fee and a lower-quality (or feature limited) version offered for free (or a very low price). This strategy can be observed through a variety of different approaches: Feature-limited products where a full-featured version is sold at a high price (or through an update), while a version that has limited features is freely available. Time-limited products where users have access to a full-featured product for a set period of time, and have to purchase a full version after the time trial expires. Usage-limited products where users have access to a set number of free instances but are required to pay for a larger number of instances.

Offering tiered products (different quality tiers of the same product) is a long-established product design idea. One famous example is the case of printers, where the same printer technology was used to create a series of products at different price points. Since the quality differentiator was print speed, printer manufacturers would create a high-speed printer, then artificially slow down the printing speed in order to create lower quality versions they could sell at lower prices (Deneckere & McAfee, 1996). However, with physical products, this approach could only be feasible in certain settings. With the growth of software and the internet from the 1980s and 1990s these tiered strategies became far more widespread (Hui & Chao, 2002). America Online (AOL) famously used to mail free demo (demonstration) disks to people or attach them to newspapers, providing users with a few hours of free online surfing, but also with the opportunity to pay if they wanted to spend more time online. Particularly during the period where software was distributed by disks and CDs, the strategy of providing a free demo (either feature or time-limited) became the dominant model of marketing software. Consumers could try out a product before purchasing. This model remained largely unchanged until the early 2010's when software consumption started shifting in two important ways. First, software purchases shifted to online sales, direct-to-consumers through storefronts such as the App Store. These storefronts made it possible to offer multiple versions of the same product, through creative features such as in-app purchases, which would allow consumers to access a free product, and then purchase additional features or functionality. Second, software providers began to shift to more cloud-based services that are sold through a subscription or per-use basis. These services providers often offered a free version of their products which contained limited functionality, but then charged for more intense users.

Most digital products which we observe today have some freemium component. Newspapers provide only some articles for free, while others are behind a paywall. Sometimes, they provide a teaser of the article but require you to subscribe to read the rest of the article. Streaming services (Peacock, Hulu, Netflix, Paramount+) all have tiered approaches, either providing a free or discounted basic service (with either limited features or increased nuisance such as commercials) along with a premium service. Cloud Storage providers such as Dropbox, Box, Google Drive are all based on a model of providing free storage to consumers, hoping that more demanding users will choose to upgrade to these tools. Mobile app stores such as Google Play or Apple App Store are populated by products that offer some version of freemium strategies, either by having a pro & lite version of their products, or more commonly using in-app purchases to provide additional features. Many B2B services, such as the burgeoning sector of AI services (machine translation, image detection, etc.), provide a free tier such as that users can perform a set number of queries in a period of time, and have to pay for additional services.

Freemium in many ways represents more than just a pricing strategy. It affects how the products are designed (what features are included with which products). It creates a potential for wide-scale adoption of a product, even though very few users may become paying customers. This can impact the cost structure of a business, where a small number of paying customers have to offset the costs of a larger number of free customers (e.g. cloud storage companies have to keep the data of many free customers while being supported by a small number of paying customers). It emphasizes

operations and efficiency from the perspective of software developers creating these products, over what may have traditionally been a creative style, hit-driven industry in the past. These complex issues involving pricing decisions, product design decisions, organizational design decisions are often difficult to tackle in a single paper. Instead, most research papers focus on a particular aspect of freemium strategies, such as pricing. This makes it difficult to draw general conclusions about what are the situations when freemium is a viable strategy and what might be the other issues that firms want to consider when using these strategies, at least without reviewing this large and dispersed literature.

In this chapter, we provide an overview of the various streams of academic literature that have touched on the question of Freemium. We then discuss the general conclusions that have emerged from the literature regarding when freemium strategies might be viable, and when they might not be. However, the academic literature on freemium is at times incongruent with the empirical reality we often see. As discussed above, there are numerous successful examples of freemium approaches, yet the academic literature highlights how this may be viable under very specific circumstances. To reconcile these differences, we further discuss what aspects of freemium strategies have only recently begun to be studied and why future research into these topics might help shed light on when and how freemium approaches are best used.

2. Defining Freemium Strategies

Freemium strategies have been used to describe feature-limited products, time-limited products, usage-limited products, and multi-tiered products in general. A defining characteristic of these products, and a way of synthesizing these different definitions, is to see freemium as both a product design and pricing strategy, where firms offer a free version of their products (alongside some paid feature or version), which can enhance consumption of their products (either through more users and/or higher prices for premium features) but comes at a cost (either through cannibalized sales and/or costs of designing products for these strategies).

Freemium can be seen as an extension of multi-tiered product or product-line design strategies, as discussed in the example of printers above. However, what distinguishes freemium from these strategies is that a part of the product is available for free (zero price). In theory (as we discuss in the following section) firms can offer a version of their product at a lower price and don't have any particular reason for setting the price to zero. However, the empirical reality is that many (potentially even most) products that offer multiple versions set the price of the lower quality version at zero. There might be a variety of reasons for this. Offering a zero price simplifies the process of price setting and allows for firms to focus on optimizing the price of the higher quality products. This might be particularly relevant for digital goods can be purchased online in different geographical areas with different currencies, and therefore offering a free version might avoid a variety of transactional and accounting costs. Offering free versions makes it possible for consumers to try a product with minimal costs, which encourages a try-before-you-buy approach from customers that might be impeded by even a very low price. There may of course be consumer impressions associated with a free price, such that consumers might be cognitively more drawn to free products or might perceive free products as

being naturally inferior (Shampanier, Mazar and Ariely, 2007). While this is beyond the scope of our particular focus, there is a rich literature in psychology and consumer behavior that has explored this issue (e.g. Raghubir, 2004).

Another reason why freemium strategies might be unique is that in theory, firms might equally be likely to benefit from subsidizing the consumption of the free product (set a negative price or paying consumers to try the product) as they are with setting a price for free. However, even though the empirical reality is that firms are setting their prices to zero, it does not imply that they are not designing their products such that consumers might benefit in other ways. Music streaming services offer their products for free but compete on other dimensions of product design such as the library of content that they provide, the fidelity of the content, and other potential features to improve the consumer experience. Therefore, freemium provides a unique strategy based on offering a multi-tiered product constrained by having a free product offering, but considerably flexible with regards to the other features that might be implemented and offered.

3. Existing Research on Freemium Strategies

3.1. Theory Lens on Freemium Strategies

We begin our overview by considering the theoretical studies that have looked at freemium strategies. This is a good place to start for several reasons. First, these studies focus on the pricing decision given a single-tiered, or multi-tiered product offering. Second, these studies formalize the mechanism through which offering a free version influences the overall payoffs of a firm (e.g. larger user base, greater consumer understanding of product quality, etc.). This makes it possible to clearly articulate the tradeoff between the costs and benefits of freemium strategies. Finally, these theoretical studies link the consumer adoption decision (consumer utility function) and the firm product and pricing decisions (firm payoff function). The empirical papers we discuss later typically focus on only one of these aspects. Once we have discussed these stylized but highly informative theoretical representations of freemium strategies, we move on to discuss empirical papers in subsequent sections.

A precursor to the literature on freemium is the literature in economics-marketing-management that considered what can be referred to as product line design (Mussa and Rosen, 1978; Moorthy and Png, 1992; Deneckere and McAfee, 1996). This literature raised the concept that firms may benefit from creating value-subtracted versions of a high-quality product, which may be even more costly to produce than the original high-quality product (e.g. printers which are artificially slowed down). These papers focused primarily on physical products, where product-line design decisions basically refer to the price and quality of products they are going to be offering.

A number of follow-on studies focused on the use of such product-line design decisions but within the context of software (Shapiro and Varian, 1999; Bhargava and Choudhary, 2004; Krishnan and Gupta, 2001). This was an important context to consider because it had characteristics such as network effects, whereby the value of the product increased with the size of the user base, or quality

uncertainty, where users were not able to understand the value of a software application until they had some time using it.

A further extension of these studies considered the specific (but commonly observable) case of a firm product line with a lower quality (or value subtracted) version of the products available for free (zero price). This is zero price is important for two reasons. First, a zero price implies that the firm will generate no revenue from the lower-priced version of its products. Therefore, the benefits of the free version must be sufficiently large, that they compensate for the lost revenues that result from this lower-quality version. Second, a zero price implies that competitors might also have to set a zero price for their products, as it is challenging to sell a product when your competitors are offering it for free. This market condition, where the prevailing price is zero, creates market conditions where firms have many users, but very few paying customers.

Cheng, Li, and Liu (2015) model the optimal conditions where firms are best off providing a Time Limited, Feature Limited, or Hybrid of both. In their model, the core benefit arises from network effects which increase the value of the paid version of the product, with the overall number of users. Cheng and Liu, (2012) consider a similar situation, but instead of network effects, study the information benefits of offering a free version: reduced uncertainty around product value. Appel, Libai, Muller, and Shachar (2020) consider a variety of freemium models including either an ad-based free product, or a paid version (in-app purchase on top of free products), and model the impact of sampling as a way of understanding the value of products.

Other studies have explored information diffusion from users to prospective users in the form of word-of-mouth diffusion about the value of a product (Niculescu and Wu, 2014; Dou et al., 2013). These studies highlight an important tradeoff at the heart of using freemium models. On the one hand, while a free product may enhance the user base of a company, it also cannibalizes the premium product lines as would-be customers will instead use the free version. The only way that this is feasible is if: 1) Though network effects the value of the premium version increases with the size of a user base and therefore the firm can charge more for a premium product, as a consequence of having a free product with a large user base. 2) An information asymmetry exists which prevents consumers from understanding the true value of these products, and by offering a free version, customers will understand the full value of the product and therefore be willing to pay more to acquire it. One important feature of these papers is that they consider a single firm in isolation (monopolist). Therefore, they do not consider how a pricing decision may interact with that of a competitor.

A small number of studies consider the use of a freemium strategy in a market with multiple firms (Zhang, Nan, Li and Tan, 2016; Etzion and Pang, 2014; Pang and Etzion, 2012). By adding a second firm to the model, consumers face a choice of whether they purchase a product from firm A or firm B (rather than in the monopolist case, where consumers face a choice of whether they purchase the product, or not purchase anything). This means that consumer choices for which product to adopt are determined by the relative price and value of either product. Network effects provide an interesting complication to these models, where the value of a product increases with the size of the user base.

Therefore, the price (response) functions in these models contain a tradeoff between the price charged and profitability (lower prices attract more users, but at a lower price). Contrary to the (more conventional) logic of the monopolist case which states that stronger network effects allow firms to simultaneously charge higher prices while attracting more consumers, the reality that these models highlight is that if firms charge higher prices, they will end up attracting fewer consumers to their products. This is part of the logic behind canonical models of competition under network effects (Katz & Shapiro, 1996), which show that it is optimal for firms to set low prices in the first period such that all consumers will adopt their products, so they may charge higher prices in subsequent periods. Otherwise, it would prove difficult to charge high prices and generate higher revenues under network effects. These studies consider tiered prices strategies, where firms can offer both a low-price / low-quality product and a high-price / high-quality product, but the utility of consumers would be derived from adopting either product (Zhang et al., 2016; Etzion and Pang, 2014; Pang and Etzion, 2012). These papers don't explicitly consider free products, as that fixing prices to zero makes it difficult to solve a competition-on-a-line model. However, they convey the intuition behind freemium products. Namely, by offering a lower-priced version, firms can offset their competitors and can set very lower prices in order to increase their user base. At the same time, by offering a higher-priced version, they can extract higher revenues from those consumers that want to use premium features. These models play an important role in both highlighting the benefits of two-tiered or freemium strategies, but also the importance of jointly considering freemium strategies, network effects, and competitive interactions.

Shi, Zhang & Srinivasan (2019) focus explicitly on the case of freemium and highlight that even with strong network effects freemium is rarely optimal in a competitive setting. Instead, it may only be optimal in settings where a firm dominates the market, such that competitive pressures do not influence the product characteristics or the ability to set prices. Another important feature of this study is that it considers the optimal product quality regarding freemium. A second paper that studies this largely unexplored question is Li, Jain and Kannan (2019) which consider how product quality influences the degree to which freemium, in the form of free trial strategies, may be optimal. These results highlight how for higher quality products, freemium strategies may be beneficial. However, for lower quality products, offering free versions leads to cannibalization which is difficult to offset by paid consumers.

Summary of Theoretical Literature. We began with the theoretical literature because it highlights the mechanisms and interactions between the decisions of firms and consumers. The key insight here is that freemium strategies are a useful way for companies to increase their user base but at a cost of cannibalizing their would-be paying customers. Therefore, in order for this to be a viable strategy (i.e. allow firms to generate higher revenues than not offering a free version), there needs to be some benefit from having a large user base. This can be through network effects increasing the utility of the products, word-of-mouth diffusion creating greater awareness or social features expanding the benefit of the network. Therefore, these aspects of product design have to be considered alongside the pricing strategy in order to successfully implement a freemium strategy. These studies reviewed in this section are summarized in Table 1.

Table 1. Summary of Freemium Product Strategies

Paper	Context	Type of Study
Varian and Shapiro (1999)	Theoretical foundation for selling information goods, including versioning as a effective way to design information products.	Theoretical
Cheng and Liu (2012)	Consider optimal conditions to offer a time-trial freemium strategy, to decrease product uncertainty.	Theoretical
Niculescu and Wu (2014)	Consider optimal conditions to offer a feature limited version in comparison to seeding (offering the premium version for free to a sample of consumers).	Theoretical
Cheng, Li and Liu (2015)	Consider Optimal conditions for feature limited versus time trial strategies.	Theoretical
Appel, Libai, Muller, and Shachar (2020)	Consider differences between advertising based versus freemium strategies.	Theoretical
Pang and Etzion (2012); Etzion and Pang (2014); Zhang, Nan, Li and Tan (2016)	Consider firms offering a product along with a complementary service. Consider the case of two competing firms offering both product and a service, versus just a product. Analogous to a firm offering a higher and lower quality product.	Theoretical
Shi, Zhang & Srinivasan (2019)	Consider freemium strategies explicitly with the additional caveat of an asymmetry between a market leader and follower.	Theoretical
Li, Jain and Kannan (2019)	Consider optimal designs of free sampling strategies, which are a variant of freemium strategies.	Theoretical

3.3. Empirical Evidence for Freemium Strategies

Unlike the theoretical papers which consider both the consumer adoption decisions and the firm product design/pricing decisions, empirical studies generally focus on either the side of consumers (why consumers adopt a particular freemium product) or firms (what happens when firms offer a freemium product). Therefore, below we review these studies and summarize the main insights.

Empirical Studies of Consumer Adoption of Freemium Products. The theoretical literature on freemium strategies makes explicit assumptions about the ability of consumers to rationally observe and evaluate different alternatives. However, consumers often do not behave in such an idealized way, and the empirical studies of freemium strategies that have looked at consumers have primarily tried to understand the way in which consumers "perceive" these free offerings.

Rietveld (2018) studies how the use of freemium strategies is associated with consumer value, both using empirical evidence on video game sales and an randomized control trial that simulates the consumer purchase decision. The underlying theoretical arguments are that when firms freely reveal their products, it helps the consumers understand the value of these products. However, consumers incorrectly value these products and undervalue them when a free component is available, explained by prospect theory's *sunk cost* effect. There is a broader literature in marketing and psychology related to this phenomenon of how consumers perceive the value of free or promotional products (Raghubir, 2004; Shampanier, et al., 2007). Niemand, Mai, and Kraus (2019) consider competing consumer mentalities, one which argues that software and related products should intuitively be free, and another which argues that free products are inherently lower quality and high-quality products should cost something. They provide evidence for both of these behaviors in consumers and highlight that individuals likely have different latent intuitions and therefore will perceive free products differently. Mäntymäki, Islam & Benbasat (2020) study the motivations of users to upgrade or retain their subscriptions and find that upgrading and retention decisions are driven by different mechanisms. Upgrading to premium is often driven by the perception of value and price as has been identified by other studies, while retention decisions are often driven by factors such as the availability of new content.

Fang, Zheng, Ye, and Goes (2019) study the impact of social connections within freemium products and find evidence that greater social connections to other members of a community, enhance the likelihood that individuals will pay for premium features. Relatedly, Gu, Bapna, Chan and Gupta (2021) find that introducing crowdsourced product features are associated with great product retention and user engagement, which further suggests that social (between user) relationships may be a critical aspect of the consumer decision to upgrade to premium features.

The key insight from these studies is that in fact the consumer decision to adopt freemium products is based on a more complex set of behavioral factors that relate to how consumers perceive the value of products, given zero price. Therefore, the reality of understanding freemium choices potentially goes beyond any single mechanism. Additionally, different ways of implementing freemium

strategies (e.g. time trial, feature limited, social interaction limited) might emphasize different mechanisms relating to how consumers perceive the value of their products. For instance, for products that lend themselves naturally to community interactions, offering crowdsourced or social content may prove critical. Otherwise, for products that generate network effects based on interoperability but not social interaction per se, social features may not be as important.

Empirical Studies of Firm Use of Freemium Strategies. The other set of empirical papers that consider freemium strategies, do not look at the decisions of consumers or how they might perceive freemium products. Instead, they try to study how the use of freemium products is associated with firm performance or product sales.

Rietveld (2018) paired a laboratory study of consumers' choices (discussed above) with observational data from the Steam marketplace for video games, which showed that titles that were sold through freemium strategies were associated with lower revenues despite being more widely used. This was consistent with the laboratory study, but also provided evidence consistent with the assertion of the theoretical literature that freemium strategies are often associated with greater use, but lower revenues. Liu, Au & Choi (2014) find a similar pattern in studying mobile apps available on the Google Play (Android) store. Namely that find that offering a free trial of a high-quality version is associated with greater sales, suggesting that freemium products which allowed consumers to evaluate the high quality of the product lead to greater sales and conversions. However, they did not find that high free download rankings were associated with greater sales, which indicates that simply having a large user base was not associated with higher revenues for freemium products. Lee, Zhang and Wedel (2021) study whether choosing to launch free, paid or both versions impacts the performance of mobile apps, based on a dataset of the 584 top-downloaded android apps, and find that leading with the paid version is the most common launch strategy among this sample of successful titles. Runge, Wagner, Claussen & Klapper (2016) perform a large-scale field experiment on 300,000 users varying the types of freemium products provided and find that offering more features for free is associated with lower conversion, but higher usage. Rietveld and Ploog (2021) study how the size of the size of the network shapes whether freemium strategies will be successful, showing that freemium strategies may only be appropriate for markets with large networks (potential user base). These papers all point to the fact that freemium strategies are not associated with higher revenues overall and suggest that freemium strategies may only be appropriate in certain situations.

Variants of freemium strategies have also been used to sell other forms of digital goods, other than software. Li et al. (2019) study the use of freemium strategies by booksellers who provide free trials for their products and find that offering a free book with the opportunity to purchase a paperback version can lead to higher sales. However, they also find that this depends on the nature of the free products. If a high-quality free version is offered, then the sales of the paid version may be cannibalized, but this is greater for lower quality titles. Lambrecht & Misra (2017) consider the timing of when firms may want to offer free products and find that firms may benefit by offering free versions of their products, but in periods when demand is naturally high. The example they provide is sharing

a sports newspaper for free during the season, when low value (casual) fans are engaged but can charge during the off-season because this is the period when only high value (hardcore) fans are engaged.

There has been related work also looking at the impact of free products on the domain of entertainment (music, movies, and television). One aspect of these studies is that the free version was often not made deliberately available by the content creator. Instead, through piracy or other means, free versions of content have become available, and studies have attempted to understand the impact of these products on overall consumption and sales. Zhang (2018) studies the impact of relaxing DRM measures around music that prevent sharing and find that this is associated with 10% greater consumption, but particularly for the long-tail (less popular albums). Similar patterns were supported by Peukert, Claussen and Kretschmer (2017) who find that the shutting down of a popular source of pirated movies decreased box-office revenues which they attribute to the information diffusion effect that these free products provide. Similarly, Kretschmer & Peukert (2020) find that the shutting down of a service that provided free online music videos (similar to YouTube) reduced overall music record sales. However, these effects predominantly benefited more popular artists. Aguilar (2017) studies the introduction of a free use cap by the music streaming service Deezer and finds that this was associated with a decline in access to both lawful and unlawful alternative sources of music, suggesting that the free service helped to increase demand for these products. There are studies that have shown that the existence of these free products might in fact diminish the consumption of the premium products (Ma, Montgomery, Singh and Smith, 2014; Rob & Waldfogel, 2006; 2007).

A related instance can be the introduction of paywalls. Paywalls were introduced by many newspapers, which sought to move from an ad-based strategy where they provided free access to their newspaper articles, to a subscription-based model where consumers would have to subscribe in order to read the articles. Several studies have exploited the introduction of a paywall by the *New York Times* (NYT) in order to evaluate whether restricting free content (the opposite of freemium) impacts consumption. Oh, Animesh and Pinsonneault (2016) study the rollout of the NYT paywall and find that this led to lower demand for online articles (less readership) and also weakened social conversations about these articles. However, much like the studies of piracy, they also document that this does not affect all products equally and that for niche (long-tail) products the impact of the paywall is greater. Pattabhiramaiah, Sriram and Manchanda (2019) look at the same rollout, and document the same decline in online readership, but additionally focus on positive spillover effects on the print subscription which rises as a consequence of this paywall. Aral and Dhillon (2021) study the same setting but use a quasi-experiment that altered the paywall design. They similarly find that the introduction of a paywall reduced demand for online content but lead to an increase in online subscriptions. Their calculations regarding the economic significance of these countervailing effects suggested that the newspaper was able to generate higher revenues once the paywall was introduced, despite lower traffic. These results provide further empirical evidence of how the availability of a free version reduces the overall demand for a particular product.

The main conclusion from reviewing these studies is that the impact of freemium strategies on performance is contingent on a variety of factors specific to that particular empirical context, such

as the relative quality of the premium and free version (Liu, et al., 2014; Li et al., 2018), the timing of when free versions might be offered (Lambrecht and Misra, 2017) or the nature of competition in the marketplace (Boudreau et al., 2021). Additionally, the literature looking at piracy or pay-wall implementations indicates that free versus paid models might affect the consumption of mainstream versus long-tail products differently. Finally, these results may differ based on the types of products. Markets for software, books, newspapers, music, movies may respond differently to freemium strategies because of the inherent nature of the products. Therefore, it is helpful to have broad evidence on the impact of when freemium strategies are best used from a variety of settings.

3.4 Conclusions from Freemium Literature

The literature on freemium strategies straddles different academic disciplines, studies different implementations (types) of freemium strategies, is often focused on a specific mechanism (e.g. network effects) or on providing evidence from a specific setting (e.g. mobile apps). This is understandable as it is challenging to integrate all of these complex issues within a single model, paper, or dataset. Theory papers have often focused on explaining how a single mechanism (or channel) might jointly influence consumer adoption decisions and firm strategies. These studies highlight "when" freemium strategies might be most appropriate. Empirical papers fall into one of two categories. The first looks at how consumers evaluate freemium versus conventional offerings. The second looks at the impact of freemium strategies on either product demand or firm revenues. Understanding that each of these groups of studies has its own goal is in itself an important realization. Freemium (products, strategies, offers, etc.) is a broad label that applies to a variety of different approaches, that may be effective under different conditions and affect consumption decisions differently. No single study applies to all implementations of freemium or has insights that may generalize to all potential contexts. This highlights the importance of having so many different studies that document and explore freemium in different settings, and the need for future work to further expand on these issues. In Table 2, we summarize the empical papers studying freemium discussed above.

The main conclusion from the theoretical literature is that freemium is a strategy where firms are inherently cannibalizing their own revenue streams by offering a free product and should only do so in cases where this brings a clear benefit. The main conclusion from the empirical literature looking at the impact of using freemium strategies on product sales or firm revenues is that they are often associated with worse outcomes. This highlights that freemium strategies may be profitable, but only in a small set of cases. It certainly suggests that freemium should not be "the rule" but rather "the exception" when it comes to selling digital products. The empirical literature looking at consumer perceptions of freemium products highlights, the additional complexity that arises from how consumers evaluate and perceive products that are available for free. This highlights the behavioral features which characterize "Zero as a special price" (Shampanier, et al., 2007) and why freemium strategies are more complex than tiered product strategies which bring with them their own challenges.

While this literature provides a number of important insights, it also raises a variety of questions: If, in fact, freemium strategies are only appropriate for certain situations, why are freemium products so common? How can we explain the examples of so many prominent companies that use freemium strategies (Spotify, Skype, Fortnite, DropBox, etc.)? Additionally, does freemium require any organizational design choices or specific capabilities to go along with these pricing and product design decisions? We discuss these potential future strategies and questions below.

Table 2. Summary of Freemium Product Strategies

Paper	Context	Type of Study
Rietveld (2018)	Empirical evidence from freemium product offerings in the Steam marketplace, combined with a randomized control trial of consumer evaluations of freemium products.	Experimental and Observational Data
Niemand, Mai, and Kraus (2019)	Study why freemium strategies are often ineffective by evaluating the perceptions of individuals to freemium product offerings.	Experimental
Mäntymäki, Islam & Benbasat (2020)	Evaluate how individuals value different aspects of software products and what impacts their decision to upgrade to premium features.	Observational Data
Fang, Zheng, Ye, and Goes (2019)	Study the impact of social interactions within a freemium mobile game, on the ability to convert users from free to premium features.	Observational Data
Liu, Au & Choi (2014)	Analyze the association between using freemium strategies and product sales.	Observational Data
Lee, Zhang and Wedel (2021)	Study the most common product strategies among the subset of top-downloaded titles.	Observational Data
Runge, Wagner, Claussen & Klapper (2016)	Analyze the impact of freemium design by varying the way freemium strategies are designed in a large field experiment.	Experimental
Li et al. (2019)	Study free trials within publishing finding conditions where offering a free version can be optimal.	Experimental
Lambrecht & Misra (2017)	Consider that firms may temporally vary when they offer free content as a way of expanding demand for their products.	Observational Data
Tidhar and Eisenhardt (2020)	Study the relationship between pricing strategy and organizational design highlighting the conditions under which freemium strategies may be viable.	Observational Data

Rietveld & Ploog (2021)	Study the effectiveness of freemium products in relation to market size showing the limitation of freemium strategies in certain markets.	Observational Data
Boudreau, Jeppesen and Miric (2021)	Study the impact of network effects and market position when using freemium strategies in comparison to paid-only strategies.	Observational Data

4. Potential Directions for Future Work into Freemium Strategies

While much is known and understood about freemium strategies, many avenues for research remain. Below, we highlight some areas where existing studies have begun to uncover important questions for freemium strategies. Yet, more work is needed to truly understand these issues.

4.1. How Market Position Impacts Whether Freemium is a Viable Strategy

When academic papers (and specifically modeling papers) study the use of freemium strategies, particularly in relation to network effects, they do either for a monopolist firm, or for a symmetric duopoly (two firms with similar products). While this framework has led to a number of important insights, one aspect which it ignores is that realistically in a market some firms will be leaders (with the largest revenues or market share), while others followers (with relatively lower share of sales and revenues). This is important for two reasons. First, firms with larger versus smaller installed bases may find it helpful to switch to freemium strategies at different points. Second, network effects amplify the advantage of the leader, while harming the followers.

There are very few studies have considered the market position of firms in relation to freemium strategies. Kanan et al. (2020) show analytically how using freemium strategies may only be beneficial in cases where a market leader is dominant, and not beneficial for firms that are not market leaders (Including followers). Boudreau et al. (2021) exploit a policy change that strengthened network effects and observe how that impacted market leaders versus followers that used freemium. They find that network effects increased the advantage of leaders over followers, especially in settings where freemium strategies were used. Both studies point to the fact that freemium strategies will benefit leaders, while almost always harming followers (in comparison to the revenues they might have had in the absence of freemium strategies). Additionally, they point to the fact that freemium strategies

might benefit leaders in their ability to gain an advantage over followers, but might not lead to higher revenues, consistent with what the broader empirical literature has shown.

The underlying reason behind this is that stronger network effects tie the success of firms to the size of their user base. This creates an incentive to lower prices in order to attract as many consumers as possible. However, unless one firm dominates all others (as is, in fact, the case in canonical models of competition under network effects - Katz & Shapiro, 1996), then the firm cannot raise prices and therefore might experience lower revenues even with a larger user base. Freemium strategies help to offset this, by allowing a firm to offer multiple versions. The free version can expand the user base, while the premium version can capitalize on the customers that are willing to pay for premium features. However, in that case, as well, the free version cannibalizes potential customers of the premium version, reducing would-be revenues, even despite a large market share.

This directly shapes the two issues described above in relation to freemium strategies. First, network effects amplify the advantage of the leader, and diminish those of the follower. Therefore, freemium strategies will allow market leaders to gain greater market share, and potentially greater revenues (in some cases). However, freemium strategies will diminish both the revenues and the market share of followers. Second, it raises the question of when do firms choose freemium strategies? For market leaders, an install-base advantage, as well as network effects, might be sufficient incentive to switch to freemium strategies. This might be especially attractive if a market leader believes that it can gain a sufficient market share that it can dominate in future periods. However, if competitors are attempting to challenge such a market leader, they also have an incentive to begin using freemium strategies. That is because for followers, offering a free version ensures that they can compete against the free version of the market leader. However, in general, the follower will be coerced into this strategy by a market leader, and may not find freemium strategies viable otherwise.

Therefore, it is important to realize that this use of freemium strategies can result from short-sightedness, whereby using a freemium strategy might be beneficial in the short term before competitors also switch to freemium. However, once an equilibrium occurs where all firms use freemium strategies, the payoffs for even leading firms, may be lower than they were without freemium strategies. This pattern, which we jokingly call "freemium death spiral" is an important pattern that may emerge where freemium strategies are used. Namely, firms may begin to switch to freemium strategies and strengthen network effects around their products to dominate all other competitors. However, if they do not manage to exclude other competitors from the market, and those firms shift to freemium strategies, then an equilibrium can emerge where all firms observe lower revenues than what would otherwise occur.

These patterns might explain what we observe in many markets where freemium strategies are used. For example, mobile app markets are populated by large numbers of freemium products, but all but a few large firms are able to be profitable and successful in this space. Dropbox, a leader in the cloud storage space and known for its freemium model, has only become profitable in 2020 during the pandemic when demand for premium cloud products increased and struggled to be profitable

before, even when they commanded a considerable share of customers. Spotify struggled to be profitable with its freemium model, despite its virtual dominance of the streaming market.

4.2. Designing an Organization around Freemium Product Strategies

A key aspect of strategy is the concept of "fit" between various firm activities (Milgrom and Roberts, 1995; Siggelkow, 2011). It is intuitive to characterize freemium strategies as a product/pricing decision. However, these decisions bring with them a variety of other choices that firms make to ensure that the surrounding organization fits with this pricing/product strategy. In their study of mobile app developers, Tidhar and Eisenhardt (2020) explore the importance of the fit between revenue models (including freemium) and other organizational decisions, highlighting how misalignment can be associated with worse performance. An illustration of this fact can be seen from the evolution of video game companies. The traditional model of video game development (from the industry launch until approx. 2010) was that game developers would create a new title employing game designers, producers, artists, programmers and audio engineers to create a self-contained product (game). That product would then be put on sale either through physical means such as CD's or Disks, or through a digital download. The product would not be updated or enhanced, with the exception of bug fixes or security updates. If the game developer wanted to offer new features, they would have to create an extension that would then be sold to owners of the original titles. Since approximately 2010, free-to-play games have emerged as a highly lucrative method of producing and marketing games. Examples include well-known titles such as Fortnite, League of Legends, World of Warcraft, and Clash of Clans. These products are not a fully contained release but instead are continuously updated with new features, characters, levels, and extensions. This requires a team of developers that constantly creates new in-game content, sets prices and optimizes new product offers (e.g. Clothing and outfits that players can buy in League of Legends). In addition, it requires a marketing team that continuously attracts new players, at a per-player cost and an operational team to manage churn (loss of customers). Therefore, using these free-to-play strategies (a variant of freemium) implies a shift in terms of the organizational design, the structure of marginal and fixed costs, the importance of marketing, importance of continuously attracting users and managing churn. These costs may be considerable and are drastically different from those of the conventional model, where virtually all the development and marketing costs were incurred upfront. While the above examples are anecdotal, more exploration is needed to understand the full gamut of organizational decisions that have to be taken into account when freemium strategies are being used.

4.3 Supporting a Large Number of Non-Paying Customers

A key element of product design and pricing decisions is that certain customers have a higher value (or willingness to pay) than others. As a result, it may be more profitable to set higher prices in order to sell to a smaller number of customers. Conversely, freemium strategies are based on offering a version for zero price and so it implies having a larger number of customers, where most of the customers may be of low value (lower willingness to pay). While having a large number of "low value" customers may be helpful in increasing demand for the platform and allowing the firm to charge the

"high value" customers, these low-value customers may bring with them some often unseen costs and unintended consequences.

First, freemium strategies imply a marginal cost that is not present with other types of sales strategies. For instance, freemium games require considerable effort on the part of game developers to provide server-based functionality, new features, updates, and experiences. For example, freemium cloud storage providers (e.g. Google Drive, Dropbox, etc.) have to incur the storage costs of a large number of free tier customers. Music streaming services such as Spotify have to incur costs each time a free customer plays a song (both royalties and infrastructure costs.

Second, freemium strategies imply that the majority of customers would not be "high value". Instead, a firm offering a freemium strategy would have to acquire a large number of "low value" customers, to be able to capture a few "high value" customers. This implies that customer acquisition (marketing) costs for products with freemium strategies may be deceptively large (on average high cost to acquire on average low-value customers). While this is implied by some of the competition-on-a-line (Zhang et al., 2014; Pang & Etzion, 2012) models that consider multi-tiered strategies, it is often not translated into the verbal theory and more casual understanding of freemium strategies. As a result, freemium often has unseen costs that may need to be considered.

4.4 The Myth vs. Reality of Freemium Strategies

Freemium strategies are often discussed with respect to a few highly successful examples. Companies such as Google Drive, Spotify, Fortnite, etc. are often discussed as successes of freemium strategies. However, as the academic literature suggests freemium strategies are only profitable in certain cases. In addition, a closer look at some of these cases suggests that they may not always be profitable. Spotify, Dropbox and other titles may enjoy huge user bases but have struggled to generate a profit. Video game titles such as Fortnite and League of Legends are examples of highly successful free-to-play (a variant of freemium) products. However, there are countless mobile apps using freemium strategies that struggle to break a profit. Therefore, this raises the question of whether freemium is, in turn, a viable strategy for all firms, and if not, then in which cases might freemium actually be viable? What has made some companies successful using freemium, where most firms seemingly fail? This is particularly relevant for entrepreneurial strategy, as we might wonder start-ups attempting to emulate the success of a few exemplarily freemium products and use freemium strategies are setting themselves up to fail.

5. Conclusion and Summary

Freemium strategies are an important strategy for selling digital products, that is only likely to become more common in the future. This strategy is often discussed as a cunning strategy to both have a large number of users, and charge high prices for premium products, especially in digital industries where network effects, compatibility, social interactions (word-of-mouth) and other characteristics create a tension between having a large number of users and profitability. In this paper,

we have attempted to provide a detailed review of the literature on freemium strategies and to highlight the conclusions from this literature, as well as the potential avenues for future work.

What is clear from our review is that the literature on freemium strategies is dispersed. Different studies consider different mechanisms, contexts and implementations of freemium strategies making it challenging to form a unified theory of how freemium strategies work. However, this is not a problem. Each work that looks at a unique implementation of freemium strategies provides important theoretical and empirical evidence for how these strategies may be effective in these settings. It is helpful to understand what similarities and differences exist across software, music, movies, books and newspapers with regards to freemium services. One potential avenue for future research may be to distinguish the mechanisms that are present in different settings.

Additionally, there remain aspects of freemium studies that are understudied. We have highlighted some that have emerged from looking at the literature. However, there are potentially many other factors that can inform our understanding of what makes freemium strategies viable, and when they should be used.

In summary, freemium strategies are an important and common way of commercializing digital products. While much is understood about these strategies, a lot remains that has yet to be studied and there is an opportunity for future research to explore and disentangle these issues.

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