# Mobile Platforms as Two-sided Markets

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## ABSTRACT

Mobile platforms combine state-of-the-art mobile phones, i.e., smartphones, with innovative operating systems and so-called app stores. App stores are a special kind of search and product market. They allow consumers to search, buy and install apps for their smartphone. These apps are built for a specific operating system and provide additional functionality. App developers use the app store to promote and sell their products. Adoption by consumers and developers depends on the platform as a whole.

We introduce the notion of two-sided markets to mobile platforms. Apple's iPhone and App Store as well as Google's Android phones and market are described as a practical example. Theories of two-sided markets are reviewed and analyzed for their applicability to the mobile platform scenario. We identify and discuss promising aspects, pitfalls and shortcomings of existing models. Open research questions are revealed.

We find that Rochet and Tirole's model of two-sided markets provides a good match. It explains some of the peculiarities observed. However, as other models, it falls short of comprehensively representing the mobile scenario. Hence, we identify what a comprehensive model needs to provide and outline extensions to existing models. Furthermore, we apply the work of Parker and Van Alstyne to motivate the strategic decisions observed in the mobile market.

### Keywords

Two-sided Markets, Mobile Platforms, Smartphones, Mobile Markets.

## INTRODUCTION

With the emergence and increasing popularity of modern smartphones, marketplaces for digital distribution of software for mobile devices—better known as app (short for application) stores—became very popular. App stores can, unlike common shops in a mall, only be visited online since the applications are information goods, which are stored electronically and transferred to the buyer's mobile device via the Internet. After developing an app, developers publish the app in the store, making it available to consumers. Consumers subsequently download apps to enlarge the functionality of their devices, thereby making the hardware more valuable for them.

From an economic point of view, these electronic marketplaces can be seen as two-sided markets. Users, or—to be more precise—consumers, on one side of the market and developers on the other side exchange applications and both benefit from a large user group on the other side of the market. App stores currently successful cannot be studied independently from their environment, since they only provide applications for a specific mobile operating system, which is tied to certain mobile devices. In the following we will use the term *mobile platform* to refer to the symbiotic combination of hardware, operating system, and app store. Our research question is to what extent current models of two-sided markets are applicable to mobile platforms. In order to answer that question, we investigate Apple's iPhone and App Store as well as Google's Android phones and market. We identify and discuss promising aspects, pitfalls and shortcomings of existing models.

The remainder of the paper is structured as follows: After discussing related work, we will first present an empirical examination of special characteristics of mobile platforms with a focus on their two-sided nature. We identify two models with a high potential to fit the scenario of mobile platforms. These two are then introduced in detail and in a second step applied to mobile platforms. We highlight the implications of the models as well as their shortcomings with respect to mobile platforms. Open research topics that have been identified in the course of the paper are summarized and inspected in a discussion section. An outlook concludes the paper.

## RELATED WORK

While literature on two-sided markets in general discusses the theory from different points of view, literature on two-sided markets with focus on app stores for mobile devices or even mobile platforms is rare. Some recent literature on two-sided markets briefly touches app stores for mobile devices. (Weyl & Tirole, 2011), for example, use one subchapter of their work on intellectual property to apply their findings on pricing of intellectual property to pricing in app stores as well. Thus, they try to explain why app stores deduct 30% of revenue from developers. Research on two-sided markets with focus on mobile platforms as a whole is not satisfying.

Since 2000, two-sided markets in general have received a lot of attention in economic theory. Hence, there is a wide range of theoretic models for general and specific two-sided markets. Due to the different application scenarios and objectives, these theories differ greatly. The following overview surveys prominent models in order to determine their applicability to mobile platforms and their diffusion. The choice of models presented here is due to some degree of generality they all offer. Other models, e.g., (Bakos & Katsamakas, 2008; Schmalensee, 2002), focus on one particular aspect only and have thus been excluded.

(Parker & Van Alstyne, 2000) is a first attempt to analyze two-sided markets. The model deals with demand for a platform in the presence of network externalities and takes a strategic perspective. It is applicable to analyze the mobile market from a strategic point of view and hence discussed in more detail in the following sections.

Rochet and Tirole take a different view on two-sided markets, as they look into the operational decisions of two-sided platforms (Rochet & Tirole, 2003, 2004, 2006) Their canonical model matches the case of mobile markets to a large extent and is also described and discussed in the following sections.

(Armstrong, 2006; Armstrong & Wright, 2007) developed a model that focuses on the entrance phase in two-sided markets. They distinguish three main factors that determine the price structure on a platform featuring network externalities. These are the amount of cross-group externalities, the type of fee (i.e., flat-rate or flexible) and the occurrence of multihoming[1].

Armstrong and Wright's models only deal with the joining phase of a two-sided market during which users decide whether or not to adopt the new technology. Consequently, they cannot describe the transactions that occur on the platform after joining. While the notion of one singlehoming and one multihoming side is generally applicable, there is an assumption of sellers not charging buyers which cannot hold since apps can be sold. The model does not offer further insights into the mobile platform scenario.

(Caillaud & Jullien, 2003) model the two-sided market of matchmakers which with a certain probability find a matching pair of users from two different populations. Their model includes registration fees for joining a platform and a fee for successful transactions and looks at a market with two competing platforms. The specific type of service provided by platforms implies that at most one transaction will take place for each user. User decisions are based on their utility. In general, Caillaud and Jullien's model is not applicable to mobile platforms, as it was designed for the specific purposes of matchmaking platforms. Users of mobile platforms will typically engage in more than one transaction.

## CHARACTERISTICS OF MOBILE PLATFORMS

In recent years, the term *app store* was coined for mobile markets that mediate between mobile application developers and mobile device users to exchange software. First markets for exchanging software were run by mobile network operators, but struggled for success (Goncalves, Walravens, & Ballon, 2010). The first successful market was set up by Apple when introducing the *iPhone App Store* (West & Mace, 2010). Nowadays, the most successful platforms are owned by Apple and Google[2].

[1] In contrast to singlehoming, where actors decide to use one platform only, multihoming denotes the case in which actors participate in more than one platform.

[2] We will refer to Google's app store as *Google Market*. It has recently been renamed to *Google Play*.

They pursue different business models (Kenney & Pon, 2011): Apple offers a vertically integrated closed system, sells mobile devices with their proprietary operating system, and runs the app store. Google does not focus on selling mobile devices, but offers a free-to-license operating system, which is available open source. They do, however, cooperate closely with device manufacturers such as Samsung to ensure diffusion of new versions of their operating system. Furthermore, Google's recent acquisition of Motorola might indicate a change in their strategy. While Google captures value by offering advertised online services, Apple generates value by selling handsets and running the app store (Kenney & Pon, 2011).

The consumers' valuation of a mobile platform as a whole depends on the number of apps (and, indirectly, developers). Users will only join the platform if developers provide many applications and developers join if they can target many users. Furthermore, platform vendors can use the price level of each group as a strategic tool to attract users or developers. Thus, app stores and mobile platforms can be seen as two-sided markets. Since the emergence of operating system-centric platforms, app stores have to be examined in the context of the mobile device ecosystem consisting of the combination of hardware, operating system and app store. The combination of these three elements, i.e., what we call mobile platform, will be the focus in the following. The decision to join a mobile ecosystem is a simultaneous decision for mobile hardware, an operating system and the services offered by an app store. Nevertheless, the mobile device can also be beneficial for the user without using the app store, because smartphones already provide more functionality than a standard feature phone.

While the former remarks focus only on one side of the two-sided market participants, the other side (i.e., developers) faces similar decision situations. Software developed for one operating system is not transferable and cannot be used for other operating systems without substantial changes and thus cannot be provided in an app store for a different operating system than the one it was developed for (Holzer & Ondrus, 2011). Providing software on more than one app store for the same operating system is generally possible. After developers have decided for a specific mobile platform, they have to join the platform's developer program by paying a one-time registration fee ($25 for Google) or a yearly fee ($99 for Apple). They further face indirect costs for becoming familiar with the platform's software development kit (SDK), as well as hard- and software expenses for development purposes. To offer software in an app store, it can be uploaded supplemented by a description, name and a price greater or equal to zero. A transaction takes place when a user buys an app.

The developer has three options to generate money from a consumer: charging for the app, selling additional services within the app and advertising inside the app. The first two involve an exchange of money directly between user and developer for which app stores usually charge a 30 % fee. Google itself claims that the entire fee is used to pay for transaction costs like billing settlement fees (Chu, 2008). Current market analysis surveyed a large growth of in-app purchases, where mobile device users spend money for additional services while using an app (Destimo, 2011).

## MODELS OF TWO-SIDED MARKETS

In the following, we present the two most promising models with respect to mobile markets in detail. They each take a distinct approach to two-sided markets and provide different capabilities as displayed in Table 1. Hence, they are applicable to tackle mobile markets from a strategic and an operational perspective, respectively.

| Model | (Parker & Van Alstyne, 2000) | (Rochet & Tirole, 2004, 2006) |
|---|---|---|
| Phases | Joining phase only | Joining and transaction phase |
| Transactions | All transactions with positive benefit occur automatically | User decide individually for each transaction based on their utility |
| Payments | No payments since transactions are not modeled | Payments or negotiations |
| User Decisions | Function of own valuation and number of buying consumers in the other market | Utility-based |
| Competition | Monopoly and Competition | Monopoly |

**Table 1. Comparison of Parker & Van Alstyne's vs. Rochet & Tirole's models of two-sided markets**

### Parker and Van Alstyne (2000)

The model by (Parker & Van Alstyne, 2000) segments the market into end-consumer and content provider (see Figure 1). Both sides add value to their counterpart through inter-market network externalities. The novelty in Parker and van Alstyne's approach is the possibility of a company to subsidize one market segment. A firm may design a product which is then sold at a low price in order to create price discrimination in a market that features positive network externalities. This is subject to an increase of revenue in the other market segment that outweighs the costs for subsidizing the cheaply offered product.

The authors describe the profit maximizing strategy of a monopolist. A firm may choose to discount or even subsidize a product in one segment if the profit on the complementary market increases more than profit is lost in the discounted segment.

The competition case describes the choice of a company to enter a market without expecting any profit from it if they offer a strategic complement to that product in a different market segment. The firm's profit on the complementary market will increase due to network externality benefits. Not only will the entrant be very aggressive on the new market because they need to gain market share and do not expect profit from the product. There is also the possibility that a firm will foresee the creation of that market. In that case, they have an opportunity to create a low price product that will be adopted and which creates market entrance barriers for possible opponents. This way, the market would be owned by one company only but not yield monopolistic profits. Consequently, consumer surplus would increase.

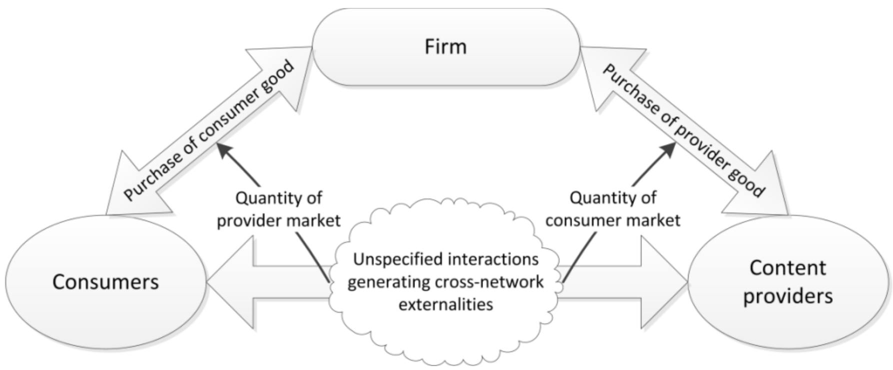


**Figure 1. Overview of the two-sided market model from (Parker & Van Alstyne, 2000).**

Negative network externalities—a situation where the prosperity of a different market segment has negative impact on the segment in focus—are dealt with in terms of strategic substitutes. Here, a firm may decide to offer a good for free on one market in order to avoid losing profits on its monopoly market. In general, exploiting externalities, i.e., optimizing prices over both markets combined, does not decrease consumer surplus on either market, as a firm cannot internalize all externalities for itself. The model does not feature a transaction phase for customers in the market.

### Rochet and Tirole (2004, 2006)

In (Rochet & Tirole, 2004, 2006), the authors present a canonical model that includes membership and usage phase and explicitly considers the case of payment between end-users. This extends an earlier paper (Rochet & Tirole, 2003), which mainly dealt with transactions only. As even the general model of the earlier paper does not include payments between end users, we henceforth concentrate on the canonical model. Figure 2 gives an overview of the canonical model with membership and usage phase. The model includes a monopoly platform on which buyers and sellers engage in transactions. They decide based on their individual utility, influenced by group-specific parameters. Users on both sides pay a fee for joining the platform, denoted by $A^B$ and $A^S$ for buyers and sellers, respectively. They gain an immediate fixed benefit from joining $(B^B, B^S)$, which is assumed to be independent of the number of users on either side. The platform incurs costs of $C^B, C^S$ per member. A transaction involves a payment $t$ from buyer to seller and transaction fees $a^B, a^S$ charged by the platform. If the price structure is neutral[3], only the total transaction fee $a = a^B + a^S$ will matter. Users also derive benefits $b^B, b^S$ per transaction and the platforms has costs of $c$. Each parameter might be zero or negative depending on the particular market.

The canonical model explicitly allows for payments and different kinds of negotiations between end-users. Only a fraction of the potential transactions will take place, as users decide about each transaction individually. When deciding whether to join

[3] A price structure is neutral if changes to the allocation of the total fee have no impact on total demand. For example, it does not matter on which side of the market, a VAT is levied.

a platform or not, users have to forecast their utility. A platform has to find the optimal usage charge level, the structure of which is neutral and does not matter as users negotiate between themselves. In many cases, a platform will subsidize transactions by setting the transaction fee lower than its cost. Furthermore, they optimize total per-transaction prices, i.e., the sum of membership and expected usage charges distributed over the expected number of transactions. The process of profit maximization by a platform has two steps. First, a price level is chosen (total price charged per transaction) and afterwards a price structure is determined (distribution of transaction charge to the groups). Optimal price level and structure are given as a function of the price elasticities of demand.

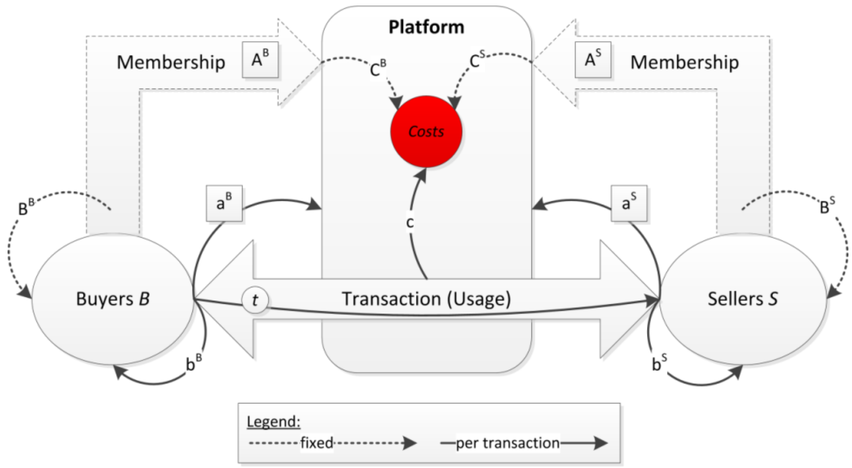


**Figure 2. Overview of canonical model from (Rochet & Tirole, 2004, 2006). *A* denotes charges, *B* benefits. Fixed components have capital letters, components occurring per transaction small letters.**

The 2006 article gives an interpretation of the implications of the model. The overall intuition applying to two-sided markets, according to (Rochet & Tirole, 2004), is that each side is charged what it can bear. Its price is inversely related to its elasticity of demand. Marginal costs might be partially or totally offset by opportunity costs, because an additional transaction by one side implies a transaction by the other side with corresponding charges as well. The same principle applies to membership pricing.

## APPLICATION OF THEORIES TO MOBILE SCENARIO

A model explicitly designed for mobile platforms would be expected to contain both, joining and transaction phase, since each of them is relevant to the platform's outcome. The joining phase is relevant because the majority of costs are fixed: smartphones prices account for the largest share of costs on the consumer side; development costs account for the major part of costs on the developer side. Transactions, on the other hand, are relevant as they add additional value for consumers and are the single reason for developers to join the platform. The model should incorporate joining fees as well as transaction fees. Furthermore, user affiliation towards platforms should be modeled in a flexible way. Namely, singlehoming should be possible for consumers as should multihoming for developers. A competition model with single- and multihoming possibilities is required, because users will hardly handle two smartphones in parallel, while developers might consider multihoming a valuable option if it is profitable for them despite increased training and development costs.

As the following discussion will show, no single model captures all of these requirements. Hence, we reviewed the two most promising models. They at least provide insights into some issues observed on mobile markets. We first analyze the strategic motivation of agents in the mobile markets by applying (Parker & Van Alstyne, 2000). Afterwards, we look into the design and pricing decisions on a mobile platform, taking as given the decision to implement the platform.

### Parker and Van Alstyne (2000)

The model by (Parker & Van Alstyne, 2000) features the joining phase only and does not regard the transaction phase. Consequently, the internal matters of mobile platforms as a whole—hardware, operating system and app store—cannot be analyzed with this model. Since it deals with the joining phase it may, however, be useful to partly describe the actions occurring on mobile platforms: The model explains how a company might enter a market and give away a product for free in order to increase the revenue in another market segment. In the context of mobile platforms and their app stores, Google basically gives away their operating system for free. They charge developers hardly anything and do not have hardware revenues as Apple does.[4] Following the reasoning of Parker and Van Alstyne, Google may have the intention to protect their business on a different market. Since Google's core business is advertising on their search engine, their involvement in the mobile platform market may merely be an attempt to secure market share in the search engine segment (Google Inc., 2012). By introducing a default search engine field on the desktop of every Android smartphone, they try to turn Android users towards using Google as a search engine. Furthermore, Google's own services like Google Mail or Google Maps have native support in the operating system. This of course augments network externalities on those services regardless of the hardware that is used to access them. Considering the reasoning above, the Parker and Van Alstyne-model may be sufficient to analyze strategies of platform providers. However, due to its lack of considering a transaction fee, it is not suitable to determine the mobile platform's internal decisions and success.

### Rochet and Tirole (2004, 2006)

The canonical model of (Rochet & Tirole, 2004, 2006) provides a good match for most properties of mobile platforms, as it includes a joining and transaction phase and takes payments between users into account. The parameter space of the model allows mapping most decision-relevant factors of mobile platforms: The benefit that consumers gain from purchasing a smartphone, not considering any app purchases, is reflected in $B^B$, while $A^B$ covers the sales price of the smartphone. The production cost is represented by $C^B$, reduced by the average revenue a platform makes per user from usage of the phone, for example from advertising next to search results that have been initiated from the mobile device.

On the seller side, $A^S$ includes costs in terms of membership charges for developer programs as well as the price of obligatory hard- and software, as long as these are bought from the platform. In total, it is equal to the average revenue of the platform from a new member during the joining phase. The cost of revenue $C^S$ of the platform then consists of all costs incurred by the platform for these products and services. With a negative immediate developer's benefit $B^S$ of joining the platform, it is possible to capture additional set-up costs for developers, for example staff training and costs for app development, that do not lead to revenue at the platform.

Regarding the transaction phase, developers set a price for their app to be paid by consumers. The buyers' utility is reduced by the payment $t$, while sellers receive this payment minus transaction charges of typically 30 %, hence $a = 0.3\,t$. The benefit of consumers obtaining the app and using it afterwards is captured in $b^B$. On the developers' side, the benefit associated with a transaction, $b^S$, is made up of several components and could be either positive or negative. It will include marginal costs for selling an additional instance of an app, for example licensing or administrative costs, as well as additional advertising revenue per app. In many circumstances, $b^S$ will be zero, since most apps are pure information goods. The platform's per-transaction cost $c$ consists of payment card charges and administrative costs.

It is safe to assume that rational buyers and sellers will decide based on utility expectations, which consist of the initial net benefit and subsequent net benefits from transactions. However, the amount of uncertainty will likely be large and might require risk-averse actors to heavily discount their expectations. The model further assumes an identical distribution of consumer benefit for all consumers, regardless of the developer. In reality, average usefulness of apps will fluctuate and can even be influenced by the developer via development effort.

With these restrictions in mind, one can confirm the general applicability of the model to the mobile scenario. The first implication of the canonical model with price setting under asymmetric information then states that mobile platforms should subsidize transactions at app stores by charging a transaction fee below its own costs, i.e., $a < c$. It is not obvious if this prediction is fulfilled in the mobile market. With Google, there are indications that they do not profit from purchases made on the Google Market (Chu, 2008). However, there is no information regarding the profitability of Apple's App Store.

By subsidizing transactions this way, platform providers can induce additional transactions that would not take place otherwise due to imperfect information. The expected benefit from these additional transactions might encourage some users to join that otherwise fall short of experiencing a positive net. Due to the indirect network effects, which lead to yet more users joining because of increased network sizes, the subsidy might be profitable for the platform, because it can recover lost profit through the enlarged network.

[4] See the section about the characteristics of mobile platforms for details.

A reason why this behavior might not be observed in the mobile market and providers instead charge transaction fees equal to or marginally higher than their costs might be that actual users, at least on the consumer side, might not base their joining decision as much on expectations about future benefits as on their immediate benefit. In this case, there would be no reason for platform providers to subsidize transactions, as they would not encourage a sufficiently large number of additional users to join.

The optimization by platforms is based on average prices per transaction, $p^B, p^S$, that are calculated by distributing fixed components over the expected number of transactions. The optimal total price level $p = p^B + p^S$ depends on the elasticity of total demand with respect to total price level. Hence, higher elasticity intuitively implies a lower price. As in most markets, reliable data on elasticities and demand is difficult to obtain for mobile platforms. However, iPhones are, on average, considerably more expensive than Android smartphones; and the membership fees for Apple's developer program also exceed those of Android. At the same time, popular opinion sees Apple's consumers as less price-sensitive and willing to spend more (Koekkoek, 2011).

Besides the price level, two-sided platforms influence demand via optimal price allocation to both sides of the market. The model of (Rochet & Tirole, 2006) predicts that platforms will increase or decrease the price of each side until an equilibrium arises, in which the side with higher average demand elasticity is charged more (Krueger, 2009). Typically, the consumer-buyer side is assumed to have a higher average elasticity, while sellers' demand is less elastic. At first sight, the actual outcome on mobile platforms seems to contradict this prediction, as membership fees for developer programs are quite low compared to smartphone prices for consumers. However, if one keeps in mind that developers also need access to hardware and operating system, most likely in larger quantities, and that they receive no subsidization, it actually might be the case that developers face higher per-transaction prices. As stated above, additional data would be needed to test Rochet and Tirole's results in case of mobile platforms.

The main drawback of the canonical model as analyzed by Rochet and Tirole is its focus on a monopoly platform. Some implications of competition might be deduced from (Rochet & Tirole, 2003), where competition increases elasticities because users have alternatives. Thus, platforms set lower prices. Extending the canonical model to include competition might lead to a similar shift. This can, however, be only a rough estimate of direction and does not have to be true under the canonical model, where fixed and variable components are inherently different and both important on their own. They open up additional strategic options, for example a mobile platform that subsidizes membership in order to attract consumers from other platforms to its app store. Hence, there is a need for analyzing non-symmetric equilibria.

The canonical model does not consider several other particularities of varying importance, either. Like most models of two-sided markets, it is not directly applicable to non-integrated platforms like Google's Android platform. Here, the mobile platform is only a theorized construct for applying the model, whereas in reality the individual parties might have diverging interests. Additionally, we did not look at further potential parties to the mobile market, like mobile service providers.

When applying the model, we assumed developers that developed only a single app. If sellers developed more than one app, the partitioning into joining phase, during which one app is developed, and transaction phase, in which this app is sold, would not accurately represent the decision situation. There would be a third phase between joining the platform and doing transactions, namely developing apps. Each phase features certain costs and benefits influencing decisions. Expenses for hardware, training, and membership fees occur once when joining, actual development costs occur for each app separately, and some costs are transaction-specific. The model further assumes no competition between developers, as the consumers' valuations of apps are independent from one another. In practice, a consumer's valuation for an app will likely decrease, if he already has a similar app or might buy one from another developer. A model that reflects this would need some means to include product differentiation within the platform.

## DISCUSSION

The analysis of models in the preceding chapter showed that these provide explanations in two different directions. (Parker & Van Alstyne, 2000) explain the strategic decisions of companies to enter the mobile platform market. (Rochet & Tirole, 2006) take the a-priori decision to enter the market as given and concentrate on the optimal design of platform and price structure. Together, both models can be used to provide explanations to some peculiarities observed on the mobile market, whereas a comprehensive model is still missing.

(Parker & Van Alstyne, 2000) present a model that is not applicable to guide or explain pricing decisions of mobile platforms. However, their strategic focus allows explaining the product strategies on a more general level. Apple, as the quasi-incumbent on the smartphone market for consumers, threatened Google's search and advertising business. Therefore, Google entered the smartphone market to defend its position on the search market. Parker and Van Alstyne's model of strategic substitutes explains that Google's strategy of subsidizing the Android operating system, which does not generate profits on its own, can be profitable for Google as a whole.

In contrast, Rochet and Tirole look at the decision space within mobile platforms. Their focus lies on optimal pricing decisions. The model from (Rochet & Tirole, 2004, 2006) is probably the best match for analyzing this general scenario, as it includes all important factors that influence decisions. While the results on the allocation of prices to either side depending on each side's demand elasticity are instructive, it is not clear whether the predictions regarding the allocation between joining and transaction phase hold in the case of mobile platforms, as no obvious subsidization of transactions can be observed.

In order to validate the results of (Rochet & Tirole, 2004, 2006) for the mobile market, the model would have to be extended to competing platforms like Apple and Google. This would require the following extensions: On the level of model design, single-homing consumers will join exactly that platform that provides the highest positive utility according to their preferences in a Hotelling model. Developers might multi-home and will join all platforms on which they will receive positive profits. However, extending the model to include competition will increase the complexity to a great extent and needs further consideration. A common shortcoming is that models do not consider the special interests of actors on non-integrated platforms such as Google.

In summary, most interesting aspects and features of mobile platforms are covered by at least one model. However, no model covers all aspects. An all-encompassing model is still needed, as the different parts of mobile platforms are closely entangled. For example, it is essential to account for both joining and transaction phase, because the expected outcome of the latter influences the decisions during the first phase, and vice versa. The design of a model kit approach, which allows combining different components of two-sided markets models, might be a worthwhile foundation for analyzing the two-sided market of mobile platforms.

In addition, models that explore other platform strategies besides profit maximization are needed, because some characteristics of mobile markets suggest that actors try to maximize their market share instead. Google might have no intention to profit from the mobile platform itself, but through distinct, yet related products, i.e., their search engine. While this can to some extent be mapped with existing models, for example by assigning corresponding benefits per user to the platform, approaches like these fall short of the expressive power of more specific models.

The models evaluated here do not provide means to take the "quality of users" into consideration, either, like consumers' willingness to pay or quality of apps provided by developers. Developers are not merely interested in the number of consumers on the other side, but in the amount of money they are willing to spend.

## CONCLUSION

Over the course of the paper, we have described mobile platforms as two-sided markets. Based on key criteria of mobile platforms, we have then identified models relevant for their two-sided market properties and applied them in order to derive explanations and insights into the mobile market.

Key insights include the explanations for Google's strategy regarding Android derived from (Parker & Van Alstyne, 2000) and the recommendations and predictions based on (Rochet & Tirole, 2004, 2006) regarding the pricing strategy of platforms. According to the former, Google is trying to maintain the level of diffusion of its search engine in face of the rising importance of mobile platforms. The latter shows that by subsidizing transactions on app stores, Google as well as Apple can attract additional customers that are willing to adopt the new technology.

However, the analysis also showed that existing models miss out on relevant factors and particularities of mobile platforms. None of the models examined includes both joining and transaction phase, while also allowing for platform competition. Hence, a more sophisticated model is needed to explain current trends in mobile markets. Designing, applying and evaluating such a model is out of the scope of this paper. However, we have given some indications on desired properties as possible starting points of future work. At the same time, additional data on mobile platforms needs to be collected, for example about costs of platforms and app development, app sales and revenue, as well as consumer trends. While this is difficult due to the closed nature of the market, more detailed insights into the mechanics of mobile platforms would be beneficial for the design and evaluation of corresponding models.

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