Obfuscation and shrouding with network effects - The Facebook/WhatsApp case

Georg Clemens*1 and Mutlu Özcan†2

1Compass Lexecon, Belgium
2Ruhr-Universität-Bochum, Germany

Abstract

This article analyses switching behavior in messaging service markets. WhatsApp’s decision to start forwarding customer data to Facebook outraged its customer base. Our model explains why, despite this outrage, switching to a rival network that does not collect data failed. In a market with network effects, where consumers either perceive excessive data collection as a dis-utility (“sophisticates”) or not (“naives”), an incumbent network refrains from collecting data until all customers joined. When naives join the incumbent’s network they never switch. The entrant network will thus be too small to compete with the incumbent who ultimately remains dominant, as the Facebook/WhatsApp case shows.

JEL Classification numbers: K21, L12, D41.

Keywords: Big data; Antitrust; Consumer protection; Excess inertia; Bounded rationality.

--

*Square de Meeûs 23 (Belgium), E-Mail: gclemens@compasslexecon.com
†Corresponding author, Lehrstuhl für Angewandte Mikroökonomik, Gebäude GC 3/150, Fakultät für Wirtschaftswissenschaft, Ruhr-Universität Bochum, 44780 Bochum (Germany), E-Mail: mutlu.oezcan@rub.de.

We would like to thank Julio Robledo and Miguel de la Mano for helpful comments.
The views expressed in this document do not reflect the opinion of Compass Lexecon, its experts or its clients.
1 Introduction

The clearance of the Facebook/WhatsApp merger by the FTC and by the European Commission has been one of the most debated decisions in merger regulation in the last years. WhatsApp was, prior to its acquisition perceived as a potential entrant in the messaging industry, as it did not process its customers’ data, thereby profiling itself as a business with a data privacy focus (see Stucke and Grunes, 2016). Conditional on the commitment not to share WhatsApp user data with Facebook, both, the FTC and the European Commission “greenlighted” the acquisition of WhatsApp by Facebook. Yet, in 2016, Facebook announced that data generated through WhatsApp would be shared with Facebook. Facebook’s decision raised severe criticism by the European Commission, politicians and consumers alike. WhatsApp thereby lost its reputation of being a company with a privacy focus outraging its customers who now saw their privacy at risk.

One of the most striking aspects of WhatsApp’s decision to forward its customer’s data is that customer’s retaliation remained limited. Although some customers initially migrated to Telegram and Threema, WhatsApp managed to remain the dominant messaging service. This remarkable fact raises following research question: How could WhatsApp prevail as the market leader in spite of infringing its customer’s privacy setting by collecting customer data? The collection of data could potentially be perceived as a dis-utility imposed on the consumers. Hence, it remains unclear why consumers stick to a messaging service that yields a higher dis-utility as compared to the alternative services.

Network effects and switching cost, creating network inertia, could potentially explain why customers did not leave WhatsApp. Yet, the European Commission found that switching cost are limited and that customers “multihome”. Another explanation for the limited response of consumers is that not all WhatsApp users realized that the disclosure of private data creates a dis-utility. Although the European Commission recognized the welfare detrimental effect of WhatsApp’s practice, most consumers seemed to be naïve with regards to the dis-utility of excessive data collection. This myopia could potentially result from a “shrouding” strategy that allows companies to deliberately limit the visibility of cost or, more generally speaking of a dis-utility associated with the usage of a service. In order to figure out if companies such as WhatsApp are incentivized to implement a shrouding strategy, we first analyse whether a shrouding-equilibrium emerges in markets with network effects. We model a monopolist operating in a market with network effects, where the monopolist can collect private data which creates a dis-utility for consumers. Consumers can either be “sophisticates” or “naives”, where the former realize that excessive data collection yields a dis-utility whereas the latter are unaware of this dis-utility. Hence the monopolist must take this consumer heterogeneity into consideration when choosing to collect data or not.

Following our results on the monopolist’s decision to collect data or not we then look
at the case of market entry by an entrant. By assumption, the entrant does not collect data. Although the entrant creates less dis-utility to consumers, switching is not observed. This stems from the fact, that the monopolist “shrouds” the dis-utility resulting from excessive data collection by formulating complicated “terms of usage”. Hence only sophisticated consumers will switch to the entrant’s network whereas naive consumers stick to the monopolist’s network. Ultimately even sophisticated customers decide to stay with the incumbent’s network, as they do not want to forgo higher network effects by switching to the smaller network of the entrant.

Our article is organized as follows: Section 2 describes the related literature. Section 3 outlines the model. Section 4 describes a situation of consumers singlehoming. We show that the incumbent firm chooses not to collect data in an early phase in order to create excess inertia. Thereby, he prevents tipping to a rival firm, which enters the market in the second stage. In section 5 we apply our analysis to a multihoming model and show that multihoming does not prevent excessive data collection. Section 6 concludes.

2 Literature Overview

One of the first contributions in the literature on network effects is the seminal model by Katz and Shapiro (1985). Katz and Shapiro (1985) are the first to model direct network effects and indirect network effects.\(^1\) Subsequently a high number of contributions to the literature on competition with network effect has emerged. Direct network effects emerge when a higher utility is directly generated with a higher number of subscriptions by other customers. Indirect network effects emerge when customers indirectly profit from the availability of services and products that initially were developed for other customers on the same network.

Messaging services such as WhatsApp or Telegram provide direct network effects to the customers since utility increases when more customers are connected to the same network. The combination of a market subject to network effects with obfuscation and shrouding strategies provides an optimal ground for the analysis of competition and customer behavior in messaging service markets.

Our model is based on Gabaix and Laibson (2006) who assume that there are two types of consumers: naive consumers and sophisticated consumers. Companies can shroud prices for an add-on product, where sophisticated consumers always take the add-on’s price into consideration whereas naive consumers do not take the add-on’s price into account. A similar approach has been adopted by Heidhues et al. (2012) and Heidhues et al. (2016). In the latter paper, Heidhues et al. (2016) introduce “socially wasteful” products that are offered to naive consumers by shrouding the attributes of this good. We slightly depart

\(^1\)Note that Katz and Shapiro (1985) also model the positive externalities larger networks generate regarding the availability of post-purchase services.
from this strand of literature, as we do not consider a transformation of naive consumers into sophisticated consumers through ‘unshrouding’. Instead we follow the observation that messaging apps with a data privacy focus, such as Threema, seem to have a limited appeal to naive consumers. This holds in spite of active promotion regarding their advantages with regards to security and data privacy.\(^2\)

We also refer to the literature on excess inertia in networks, according to which early adoptions and strong network effects drive the market outcome in one direction. Arthur (1989) shows that an early lead in adoption may lock-out a competitive firm, even if the latter is more efficient than the early leader. Both, Arthur (1989) and Ellison (2006) refer to ‘historical small events’ to classify conditions that are beyond the agents’ perception skills. Our model refers to this phenomenon when introducing adaptive expectations for naive consumers who do not feel negatively affected by excessive data collection. Another explanation follows Ellison (2006) who shows that with bounded consumer rationality where cognition is costly, consumers adopt the second-best behavior, taking cognition cost into account. Banerjee (1969) and Ellison (1993) show that bounded rationality and herd behavior, where consumers with bounded rationality follow each other, yields excess inertia; a poor standard is able to inefficiently persist due to strong network effects. According to Arthur (1989), network effects are deemed strong, when a consumer’s natural preference is outweighed due to a stronger network effect of the less-preferred product.

Farrel and Klemperer (2007) provide a comprehensive overview of the literature on network effects and switching costs. They show that networks are tippy, i.e. they are characterized by early instability and later by lock-in with excessive early power of incumbent firms. Our results are in line with this finding, suggesting that an incumbent firm will take measures in an early phase to ensure that naive consumers become locked-in. This in turn creates pressure on sophisticated consumers to stick in the network too, due to strong network effects. Our assumption of sophisticated consumers forming rational expectations follows the concept of fulfilled expectations equilibrium as stated by Katz and Shapiro (1985) and Farrel and Klemperer (2007). According to this concept, consumers form an expectation regarding the the number of adopters \(x\) and the respective price that matches exactly with the market outcome.

Our model is also directly related to the literature on multihoming. Moebius (2001) shows that with multihoming new adopters prefer to singlehome in the bigger network, as the clients of the smaller network need multihome to reach a higher scope. Our findings are in line with this to the extent that in our model naive consumers who are connected from the beginning allow sophisticated consumers to choose which network they join. Doganoglu and Wright (2006) analyse the effect of multihoming on the compatibility of products developed by different companies. Compatibility between the different compa-

\(^2\)In the Android Playstore, Threema describes itself as “The messenger with special focus on security and privacy”.


nies is reduced if consumers multihome, showing that multihoming can be welfare detri-
mental. Choi (2010) analyses the welfare effects of tying when multihoming is possible. Surprisingly, tying is welfare increasing when multihoming is allowed. This stems from
the fact that tying induces more consumers to multihome and makes platform-specific exclusive contents available to more consumers.
We are in line with the literature on multihoming, as we model multihoming as the possibility to benefit from the maximal network benefits. Moreover we asses the effect of multihoming on excessive data collection, where multihoming between a company that does not collect data and a company that collects data takes place. Our model is therefore in line with the contributions by Doganoglu and Wright (2006) and by Choi (2010).

3 The Model

We consider a game which consists of two stages. In the first stages, an incumbent firm $I$
offers network access, which can be bought at some (visible) download fee $f_I$. Consumers
decide whether to connect according to their expected utility. The network size realized in
stage 1 has an influence on the outcome in stage 2. As it will be shown later, the network
size in stage 1 determines whether an entrant firm will be able to enter the market at all.
The two networks are incompatible. We assume that both firms have perfect information.
The consumers are divided in two groups, where “sophisticates” have complete inform-
ation. The remainder of consumers are referred to as “naives”. Naives have adaptive
expectations on the network size in stage 2. Subsequently, we analyze a singlehoming case
and a multihoming case. The singlehoming case refers to a situation where consumers
can either use the network of the incumbent or the entrant, but not of both at the same
time. The multihoming case refers to a situation where consumers can use both networks simultaneously.

Consumers

We assume that a mass 1 of consumers benefits from network effects by connecting to
a network. The surplus derived from connectivity positively depends on the number
of users connected to the network. Each consumer builds an expectation regarding
the number of users $x_i$ connected to the networks of the incumbent $I$ and the entrant
$E$, respectively. For an expected network size $x^e_i$ of firm $i = I, E$, a utility $v(x^e_i)$ is
experienced. Here $v(\cdot)$ represents the valuation of the network size where we assume that $v' > 0$, following Katz and Shapiro (1985). There is an upper bound for the valuation
given by $v(1)$, where the valuation is maximal, if all consumers join a network.
Although we assume that consumers are homogeneous with regards to their valuation of
the network size, we introduce two types of consumers who differ in their ability to identify
a dis-utility emerging from excessive data collection. Following Gabaix and Laibson (2006) and Heidhues and Kőszegi (2011) we model naive consumers (“naives”) and sophisticated consumers (“sophisticates”). Sophisticates are always aware of the dis-utility associated with the collection of data whereas naives do not perceive the dis-utility as such, if the network operator “shrouds”. The share of sophisticates is given by $\eta \in (0, 0.5)$, whereas the share of naives is given by $1 - \eta \in (0.5, 1)$. Deviating from much of the literature we impose this assumption on the share of each group, which we justify by the observation that supposedly only a minor part of the users of messaging apps is aware of data protection issues. As outlined above we assume that sophisticates have complete information about the game. Moreover, they have rational expectations on the respective network sizes following Katz and Shapiro’s (1989) concept of fulfilled expectations equilibrium. Naives are subject to bounded rationality and thereby face an informational disadvantage. They build adaptive expectations on the incumbent’s network, following historical events, i.e., naives expect the network in stage 2 to realize the same size it did in the preceding stage, hence $x_t^{c,n} = x_{t-1}$. Both, naives’ and sophisticates’ set of actions is given by the decision to connect to the incumbent’s network or not in the first stage and by the decision to connect to one of the two networks or not to in the second stage. We show that the boundedly rational course of action of naives results in an inefficient market outcome.

**The Incumbent**

An incumbent can generate profits by providing the network service to consumers in two different ways. By imposing an up-front fee $f_I$ on the customers, which has to be paid only once, the network operator directly benefits from subscriptions. Moreover, a messaging operator can indirectly profit from customers’ subscriptions by collecting their data. The collected data is then used to design customized advertisement for companies that wish to advertise their products to customers. We postulate that network operators face zero marginal cost and zero fix cost, as this does not affect the resulting outcomes.

We assume that excessive data collection creates a dis-utility $a$ to the consumers and generates an income to the network operator, that exactly corresponds to the dis-utility $a$.\(^3\) This reflects an important aspect of data collection. Although data collection works exactly the same way as “additional prices” introduced in Heidhues et al. (2016), data collection should not be perceived as a money transfer. This stems from the fact that data is non-rivalrous. Moreover data collecting companies are rarely interested in collecting existing consumer data such as age or sex. Instead we should perceive data collection as a process, where companies create utility together with their consumers. Users profit

\(^3\)We abstract from possible efficiencies resulting from data collection for consumers. Such efficiencies would potentially increase consumer's utility on the data collecting network. Hence switching to a network that refrains collecting data would be even more unlikely and strengthen our result that competition does not prevent excessive data collection.
from using the services offered by Facebook and Google and to a certain extent also from advertising that can be informational for customers. Companies profit from the data generated through this process, as for instance search results by consumers on specific goods and services. Yet if data collection is excessive the service offered under-compensates the consumers with utility.\(^4\) The loss in privacy that is associated with it would then correspond to \(a\).

Once a provider chooses to collect data, this is associated with an additional cost for the consumers amounting to \(a\). By deciding upon which kind of data to be collected and processed the data collecting firm can directly decide on the magnitude of \(a\). The value of \(a\) is equal for all consumers, following the homogeneity assumption regarding the utility of consumers. Sophisticates are not only aware of the fact that excessive data collection creates a dis-utility \(a\), but are also aware of its magnitude.\(^5\) Hence we model sophisticates’ and naives’ expected net utilities from connecting to the incumbent’s network as follows:

\[
\begin{align*}
    u_s^I &= \max \{v(x_{e,s}^I) - f_I - a, 0\} \\
    u_n^I &= \max \{v(x_{e,n}^I) - f_I, 0\}
\end{align*}
\]

The incumbent’s set of actions in each stage is given by \(f_I \in [0, v(1)]\) - as \(v(1)\) denotes the highest possible willingness to pay of consumers for the network service - and by the decision on whether to collect data and if so, which kind of data to collect. As outlined above, this results in a specific value \(a \geq 0\). We therefore regard \(a\) a second (indirect) decision variable, as the magnitude of \(a\) involves the corresponding amount and types of data to be collected. To allow for the possibility that sophisticates connect even with excessive data collection we assume that \(a \leq v(1)\).

### The Entrant

We assume that in a second stage, an entrant that does not collect data enters the market. This assumption is important as we want to infer whether data privacy issues can be solved by competition. We therefore deliberately impose \(a = 0\) for the entrant in order to model the strongest competitive constraint with regards to data collection.\(^6\) We infer the reaction of the monopolist and the resulting outcome. Furthermore, we examine how the incumbent effectively deters market entry. The two messaging networks are not compatible. The incumbent observes whether or not the entrant enters the market at the

\(^4\)Note that the data legislation recently adopted by the US Government allows ISPs to sell customers data without their prior consent, accentuating possible problems associated with excessive data collection at the expense of customers (See https://www.theguardian.com/technology/2017/mar/28/privacy-protection-sell-web-browsing-history-data)

\(^5\)See Oezcan (2017) for an analysis where sophisticated consumers instead build expectations on \(a\)

\(^6\)Moreover this assumption adequately reflects the competitive situation in messaging services, as WhatsApp faces competition by companies such as Threema and Telegram, who do not collect customer data.
beginning of stage 2. The entrant faces two potential market entry hurdles: first, naives do not perceive the dis-utility of excessive data collection. Hence naives do not perceive any objective advantage from the entrant’s strategy not to collect data. Secondly, we assume that both, sophisticates and naives, suffer from switching cost. Switching costs occur in markets for messaging services when consumers download the entrant’s messaging service. These costs reflect the problems associated with the migration of chat protocols and the difficulties associated with handling the new software. We model sophisticates’ and naives’ expected utilities from connecting to the entrant’s network as follows:

\[
\begin{align*}
    u^E_s &= \max \{ v(x^{c,s}_E) - f_E - \delta, 0 \} \quad (3) \\
    u^E_n &= \max \{ v(x^{c,n}_E) - f_E - \delta, 0 \} \quad (4)
\end{align*}
\]

where the parameter \( \delta \) represents the switching cost. We assume \( \delta \in [0, v(\eta)] \) to ensure that the entrant’s network is viable, i.e. the switching costs are low enough, if only sophisticates - i.e. the minor fraction of consumers - connect to the entrant. The upfront price imposed by the entrant is expressed by \( f_E \). As opposed to the incumbent, who potentially already has a consumer base, the entrant has no consumer base to start with at the beginning of the second stage. It is therefore unclear whether or not the entrant will ever reach the critical mass. If not, the entrant will not survive in the market. The entrant’s strategy is described by \( f_E \in [0, v(1) - \delta] \) in stage 2.

**Market Equilibrium**

The structure of the game is as follows: We consider a sequential game consisting of two stages.

1. In stage 1, the incumbent decides on the magnitude of \( f_I \) and whether to collect data. If so, he additionally decides on the extent of data collection, which results in an additional (shrouded) fee \( a \).

2. Naives and sophisticates, based on the net utilities they expect in that stage, decide whether to connect to the incumbent or not.

3. In stage 2, an entrant firm enters the market. It decidedly does not collect data.

4. The entrant and the incumbent simultaneously decide on their download fees. The incumbent additionally newly decides on whether to collect data or not.

5. Sophisticated and naïve consumers decide which provider to join. This may entail switching from the incumbent to the entrant. Unlike in stage 1, in stage 2 all consumers are supposed to connect, as the entrant puts downward-pressure on the download fees in a way such that sophisticates will join.
In the first stage, a monopolist sets a download fee $f_I$ for the app and decides to collect data or not. Thereafter, consumers make their connection decisions. Naive consumers observe $f_I$ and decide whether to connect or not. Their decision is based on $f_I$, as well as on their expectation on the network size. Sophisticated consumers observe $f_I$ and the data collection decision. Based on their rational computation of the expected network size, they collectively decide whether to connect. They do so if they can expect a net utility greater than or equal to zero. In the beginning of the second stage, an entrant observes the network size of the incumbent that resulted in stage 1 and examines whether it can profitably enter the market. If the new firm does enter the market, the firms are assumed to compete à la Bertrand. They simultaneously set their upfront prices, the incumbent firm additionally decides on excessive data collection. Thereafter, consumers take notice of these decisions, naives only of the upfront prices, sophisticates of the respective upfront prices and the incumbent’s decision to collect data or not. Based on these observations and on their expectations on the respective network sizes, each group decides to which provider to connect. For a detailed analysis we distinguish between a singlehoming case and a multihoming case. We compute the resulting equilibrium via backward induction. Naives’ adaptive expectations in the beginning of stage 2 are taken into consideration by all participants. The incumbent’s objective is to maximize its total profits over both stages. As it will be shown, a necessary condition for this to hold is to reach a network of size 1 in stage 1, even if this may involve a lower profit level in that stage taken in isolation. Sophisticates have rational expectations on the resulting network size. We assume that in equilibrium their expectations according to Katz and Shapiro (1985) be fulfilled.

4 The Singlehoming Case

We distinguish between the case where both, naives and sophisticates, connected in stage 1 and the case where only naives connected in stage 1. Notice that there is no equilibrium in stage 1 in which only sophisticates connect, since naives’ willingness to pay is always higher, suggesting that if sophisticates connect, naives will do so, anyway. As we are looking for the subgame perfect equilibrium of the 2-stage game, we start by exploring the profit-maximizing second-stage outcome and then derive the equilibrium strategy via backward induction. We first provide a brief overview on the actions in stage 1 which lead to the different network sizes to start with in stage 2.

Network tipping in second stage

We start our analysis with the case where naives connected to the incumbent’s network in stage 1, whereas sophisticates did not. Depending on the magnitude of $f_I$ and $a$, this will be profit-maximizing for the incumbent in stage 1, taken in isolation. However, the
question is whether this action will be the appropriate course in order to maximize the incumbent’s overall-profit. As has been outlined, due to their adaptive expectations, in stage 2 naives expect the incumbent’s network to realize the same size as in stage 1. It follows that the maximum possible expected utility increase for naives resulting from a switch to the entrant’s network is $v(1) - v(1 - \eta)$, which is when sophisticates in stage 2 join the entrant. Notice that naives actually do not know that a fraction $\eta$ of the consumers is “sophisticated”. However, they notice that a fraction $\eta$ of the consumers did not join the incumbent’s network in stage 1. Therefore they expect to encounter this fraction in the entrant’s network in stage 2. Consequently, if $\delta$ is higher than $v(1) - v(1 - \eta)$, naives will never switch to the entrant’s network, even for $f_E = 0$. As we are interested in the case where customers potentially switch from the incumbent’s network to the entrant’s network we formulate following assumption

**Assumption 1** The utility resulting from a network size increase corresponding to the share of sophisticates, always exceeds the switching cost so that $v(1) - v(1 - \eta) > \delta$.

In this case the entrant charges a price $\bar{f}_E = v(1) - v(1 - \eta) - \delta$. Under these circumstances all consumers would connect to the entrant and the network tips. To show this consider that sophisticates expect $u^*_E = v(1) - \bar{f}_E - \delta$ in the entrant’s network and $u^*_I = v(\eta) - f_I - a$ in the incumbent’s network. Sophisticates thus connect to the entrant’s network in stage 2 iff

$$v(1) - \bar{f}_E - \delta \geq v(\eta) - f_I - a \iff \bar{f}_E \leq v(1) - v(\eta) - \delta + a + f_I$$

Since $v(\eta) < v(1 - \eta)$, this price level exceeds the price set by the entrant, $\bar{f}_E$, so that both, sophisticates and naives connect to the entrant’s network. The incumbent therefore makes no profit in the second stage and loses its complete customer base. The total profit of the incumbent in this case corresponds to $ar{\pi}_I = (1 - \eta)[v(1) + a]$.

**No Tipping**

If the incumbent in stage 1 prices such that his network reaches size 1, naives will not switch to the entrant’s network in stage 2, as their expected utility in the incumbent’s network in the second stage is $v(1)$. This value is never exceeded by the value of connecting to the entrant’s network due to the switching cost. Notice moreover that $f_I = 0$ in the second stage as naives already paid the upfront price in the first stage. Sophisticates are aware that naives will not switch and that the network size of the entrant can be at most $\eta$. They will only switch to the entrant’s network if $v(\eta) - \bar{f}_E - \delta > v(1)$, which never holds. Clearly, if the incumbent does not collect data, there is no need for a new network.

---

7 Notice that sophisticates have complete information. Therefore, they know that under $f_E = \bar{f}_E$ naives switch to the entrant’s network.
However, the incumbent could decide to introduce excessive data collection in the second stage in order to obtain additional revenue. This can be done at zero cost. We denote the incumbent’s profit in this case as \( \hat{\pi}_I \). As naives would not perceive to be affected by this they would remain in the incumbent’s network in any case. Sophisticated consumers, however, might switch to the entrant, if their loss in network size is low enough. The incumbent will make an overall-profit of \( \hat{\pi}^n_I = v(1) + (1 - \eta)a \), if sophistics switch to the entrant and \( \hat{\pi}^s_I = v(1) + a \), if they stay in the incumbent’s network.

The first stage: Monopolistic pricing and data collection

The incumbent’s objective is to maximize his overall profit, even if this may involve a lower profit level in each stage taken in isolation. In stage 1, taking the two consumer groups’ respective willingness to pay into account, the incumbent can decide on excessive data collection and set \( f_I \) such as to make sure that all consumers connect. According to (2), naives’ maximum willingness to pay for the incumbent’s app is \( f_I = v(1) \). Naives are not aware that a fraction \( \eta \) of the consumers does not have the same expected utility as they have. Sophisticates’ maximum willingness to pay is \( f_I = v(1) - a \). As the profit level of the incumbent when charging this upfront price, \( \pi_I = v(1) \), is no different from his profit when he does not collect data we state following lemma:

**Lemma 1** In stage 1, sophisticated consumers only connect to the incumbent’s network, if he does not collect data.

Consequently, the monopolist sets \( f_I = v(1) \) in stage 1. His network realizes the size \( x_I = 1 - \eta \) when he collects data and \( x_I = 1 \), if he does not collect data. In the subgame perfect equilibrium, the incumbent will choose a strategy as to maximize his profit over both stages.

Consider the case where the incumbent charges a download fee \( f_I = v(1) \) and collects data and in the first stage. Only naives subscribe to the network as they do not perceive the dis-utility from excessive data collection. Hence, the first stage profit corresponds to \( (1 - \eta)[v(1) + a] \). As outlined in the former section, this will in turn deter naives from sticking to the incumbent’s network. Ultimately they will switch to the entrant’s network in stage 2. In this case the incumbent would only make first stage profits \( \bar{\pi}_I = (1 - \eta)[v(1) + a] \).

Comparing \( \bar{\pi}_I \) and \( \hat{\pi}_I \), shows that \( \bar{\pi}_I < \hat{\pi}_I \) always holds, suggesting that \( f_I = v(1) \) in stage 1 and excessive data collection only in stage 2 constitutes the incumbent’s subgame perfect equilibrium strategy. The game tree below illustrates the structure of the game, concentrating on the incumbent’s strategies, where the associated best responses of the consumers and the entrant are taken as given.
This strategy ensures that the incumbent has a loyal customer base when a new firm possibly enters the market in stage 2. Moreover, if the network effect outweighs their disutility from excessive data collection, sophisticates, too, stick in the incumbent’s network. We thus formulate the following proposition:

**Proposition 1** The incumbent does not collect data in the first stage so as to incentivize sophisticates to join his network. By this the incumbent guarantees that naives become locked-in in the second stage and ultimately prevents network tipping.

This result provides an explanation as to why WhatsApp initially restrained from excessive data collection. If WhatsApp had engaged in obfuscative and excessive data collection in an early stage, sophisticated consumers would have left WhatsApp and switched to a messaging service that refrained from excessive data collection. This would have induced naive consumers to switch as well. Hence, by restraining from excessive data collection at an early stage, WhatsApp guaranteed that sophisticated consumers would stay connected. Naive consumers thus were locked-in to the extent that they would not leave the network at a later stage, as they only perceived the advantage of the larger network but failed to perceive the potential disadvantage of excessive data collection. This yielded a chain reaction as sophisticated consumers who were ready to switch to alternative services such as Threema or Telegram realized that naive consumers would stick to WhatsApp. WhatsApp could thus collect data without risking to loose consumers to other networks. The naive consumers are subject to excess inertia, leading to a dysfunctional equilibrium.

### 5 The Multihoming Case

Consumers are said to multihome if they use both networks at the same time. In the case of messaging services, this applies to the situation where they download and run two or more distinct platforms for messaging services simultaneously on their devices. Multihoming provides the advantage of being connected with users of all platforms thereby maximizing
the scope of the network. However, this advantage comes at higher costs as connectivity with two networks has to be guaranteed constantly.

We refer to Estevenson-Sorensen and Peretti (2012) who find that negligible “thumb-press costs” from using the remote control are responsible for inertia in the switching behavior of television watchers in Italy. Watching the TV can be regarded as a multihoming environment, as consumers are able to access different TV stations on the same device. Similar to Estevenson-Sorensen and Peretti (2012), we assume that switching among the different messaging services on the device involves an additional cost component which singlehoming consumers do not face.

Moreover multi-lateral communication for messaging groups is limited if the consumers are split among different networks. We introduce a parameter \( \xi \) which shall represent this cost, assuming that this expense is lower than the switching cost \( \delta \), consumers face when they do not multihome \( \xi < \delta \leq v(\eta) \).\(^8\) Sophisticates’ expected utility in the second stage is given by

\[
\begin{align*}
    u^s &= \begin{cases} 
        v(x_{I,s}^e) - a & \text{stays connected to incumbent in stage 2} \\
        v(x_{I,s}^e) - f_I - a & \text{connects only with incumbent in stage 2} \\
        v(x_{E,s}^e) - f_E - \delta & \text{connects only with entrant in stage 2} \\
        v(\min\{x_{I,s}^e + x_{E,s}^e, 1\}) - f_I - f_E - a - \xi & \text{connects to both networks in } t = 2 \\
        v(\min\{x_{I,s}^e + x_{E,s}^e, 1\}) - f_E - a - \xi & \text{additionaly connects to entrant in } t = 2
    \end{cases}
\end{align*}
\]

In the case of multihoming, we assume that \( \delta = 0 \), since the consumers do not suffer any switching costs, as suggested by Doganoglu and Wright (2006) and Choi (2010). Furthermore, if a consumer downloaded the incumbent’s app in the first stage, \( f_I = 0 \) in the second stage. Naïves face a similar expected utility function, except that they do not perceive excessive data collection as a dis-utility. As it has been shown in the former sections, naïves always connect to the incumbent in the first stage. This stems from the fact that the incumbent always prices so as to make sure that naïves always connect. The representative naïve’s perceived utility is described by

\[
\begin{align*}
    u^n &= \begin{cases} 
        v(x_{I,n}^e) & \text{if he joins the incumbent’s network} \\
        v(x_{E,n}^e) - f_E - \delta & \text{if he switches to the entrant} \\
        v(\min\{x_{I,n}^e + x_{E,n}^e, 1\}) - f_E - \xi & \text{if he connects to both networks}
    \end{cases}
\end{align*}
\]

Following the analyses in the preceding section with singlehoming, we distinguish between two cases: In the first case the incumbent’s network is of size \( 1 - \eta \) in stage 1, which

\(^8\) As Doganoglu and Wright (2006) and Choi (2010) both assume, multihoming yields the same benefits as compatibility. Yet multihoming is still not completely costless as clarified above, so that \( \xi \geq 0 \).
happens if sophisticates expect to face a negative surplus and therefore do not download the incumbent’s app in the first stage. In the alternative case the incumbent’s network is of size 1 in the first stage - i.e. all consumers connected in the first stage.

**Naives multihome**

We first consider the case where naives connected to the incumbent in the first stage, whereas sophisticates did not, i.e. \( x_I = 1 - \eta \) in stage 1. The maximum possible increase regarding the network effect for naives corresponds to \( \nu(1) - \nu(1 - \eta) \). As (6) suggests, for naives it is always better to additionally download the entrant’s app - i.e. to multihome - than to completely switch to the entrant’s network. This stems from the assumption that \( \xi < \delta \). They download the entrant’s app, if \( \nu(1) - f_E - \xi \geq \nu(1 - \eta) \), which, according to Assumption 1 is satisfied for values of \( f_E \) low enough. Hence the entrant charges \( f_E = \nu(1) - \nu(1 - \eta) - \xi \) so as to attract naives. Sophisticates, anticipate this outcome and can therefore choose which network to join. They will always reach the maximum possible network scope. The expected utility for a representative sophisticate is

\[
u^S = \begin{cases} 
\nu(1) - f_I - a & \text{if he joins the incumbent’s network} \\
\nu(1) - f_E - \delta & \text{if he joins the entrant’s network} \\
\nu(1) - f_I - f_E - a - \xi & \text{if he downloads both apps}
\end{cases}
\] (7)

As their expected utility is lower when they multihome as compared to the case, where they singlehome on the incumbent’s network, sophisticates never multihome when they know that naives multihome. Intuitively, this provides them a comfortable position: they have the maximal network effects without facing the expenses of downloading and running two apps. To examine the equilibrium outcome consider the incumbent’s overall-profit. It is

\[
\pi_I = \begin{cases} 
(1 - \eta)[\nu(1) + a] + (1 - \eta)a & \text{if he serves naives only in stage 2} \\
(1 - \eta)[\nu(1) + a] + \eta f_I + a & \text{if he serves sophisticates, too}
\end{cases}
\]

suggesting that the incumbent is ready to engage in fierce price competition in order to attract sophisticates to his network. He is ready to set a minimal (upfront) price of \( f_I = 0 \) in stage 2. If he opts for price competition, too, the entrant could potentially generate zero profit. We distinguish between two possibilities on behalf of the connection behavior of sophisticates.

- If \( a \leq \delta \), the incumbent is able to charge an \( f_I \) such as to guarantee that sophisticates connect to his network in stage 2. The price equilibrium is derived from \( u^*_I = \nu(1) - f_I - a \geq \nu(1) - \delta = u^*_E \Rightarrow f_I = \delta - a \), i.e. the incumbent prices such
as to make sure that even for \( f_E = 0 \) sophisticateds obtain a higher utility in the incumbent’s network.\(^9\)

- If \( a > \delta \), the incumbent in equilibrium charges \( f_I = 0 \). The entrant charges a price slightly below \( a - \delta \), which stems from \( u_E^I = v(1) - \delta - f_E > v(1) - a = u_I^I \). Would the incumbent charge a positive upfront-price, the entrant could increase his price, too. But then, the incumbent would immediately try to undercut the entrant again and latter would be forced to lower his price down to its prior level. It follows that in equilibrium \( f_I = 0 \). However, the entrant will only try to attract sophisticates to his network, if his profit in that case is higher as compared to his profit level when serving only naives. Clearly, this condition holds, if \( a - \delta < v(1) - v(1 - \eta) - \xi \), i.e. at the price which the entrant charges to ensure that naives connect, sophisticates are attracted, too. If \( a - \delta < (1 - \eta)[v(1) - v(1 - \eta) - \xi] \), the entrant refrains from attracting sophisticates and leaves them to the incumbent. Notice that here we do not consider the case where the entrant tries to attract sophisticates only.

This result clarifies that for lower switching costs, the incumbent is vulnerable, as the entrant could potentially attract customers yielding network tipping. Hence companies such as Facebook strategically influence customer’s switching costs to increase switching costs.\(^10\) WhatsApp’s messaging services could potentially be integrated further in the Facebook service bundle which includes social network services provided through Facebook and photo-sharing services provided through Facebook’s Instagram. Thereby Facebook could reduce consumer churn ensuring that the switching cost \( \delta \) exceed the dis-utility of excessive data collection \( a \).

**Naives do not multihome**

If sophisticates did connect to the incumbent’s network in stage 1, i.e. if \( x_I = 1 \) in stage 1, naives expect the network to take the same in stage 2, i.e. \( x_{e,n}^I = 1 \). According to (6), naives expect the highest utility when singlehoming in the incumbent’s network. Hence, sophisticate’s expected utility is given by

\[
u^S = \begin{cases} v(1) - a & \text{if he stays on the incumbent’s network only} \\ v(\eta) - f_E - \delta & \text{if he switches to the entrant’s network} \\ v(1) - f_E - a - \xi & \text{if he multihomes} \end{cases}
\]

\(^9\)Any price above \( f_I = \delta - a \), the entrant would try to undercut. Thus this is the only price that constitutes a stable equilibrium.

\(^10\)See Prince and Greenstein (2014) who show that the bundling of telecommunications services reduces customer churn, i.e. the incentive to switch to the competitor. Hence bundling can artificially increase switching cost.
The function derived above suggests that sophisticates do not obtain a higher utility when they multihome. Multihoming is dominated by singlehoming. Comparing the level of expected utility for singlehoming with the incumbent to the expected utility of singlehoming with the entrant, we deduce that sophisticates do not switch to the entrant’s network if
\[ a \leq v(1) - v(\eta) + f_E + \delta := \bar{a}. \]

**Proposition 2** If sophisticates connect to the incumbent’s network in the first stage, they will be locked-in in the second stage if excessive data collection is limited to \( \bar{a} \).

Our results show that, with multihoming too, network inertia is responsible for an inefficient outcome. Market forces can limit the magnitude of \( a \) but cannot effectively contain excessive data collection. Even an entrant that refrains from excessive data collection will only impose a limited constraint to the data collecting incumbent. Moreover the critical value \( \bar{a} \) increases for increasing values of \( \delta \). This again suggests that companies such as Facebook have an incentive to increase switching cost by bundling services such as WhatsApp, Facebook and Instagram.\(^{11}\)

As competition does not solve the problem of excessive data collection, we argue that competition law may not be an adequate tool to tackle excessive data collection. Instead our results show that there is a necessity of strengthening consumer protection laws and regulation. When the number of sophisticates is high enough, switching to the entrant network that refrains from collecting data occurs. Hence raising consumer awareness of excessive data collection and its disadvantages may be an appropriate measure to mitigate excessive data collection.

### 6 Conclusion

This paper clarifies why a network operator that collects data must not fear competition by an entrant who does not collect data at all. By initially renouncing excessive data collection the incumbent network operator ensures that both, naive consumers and sophisticated consumers connect to his network. A messaging service provider such as WhatsApp benefits from the presence of naive consumers who do not perceive the disutility of excessive data collection. Hence, if the network operator introduces excessive data collection the naive consumers do neither perceive a decrease in utility for themselves nor for the sophisticates, so that only sophisticates are prone to switching. As the size of the “entrant” network will therefore always be limited to sophisticated consumers, the latter may ultimately decide to stay with the data collecting incumbent. Moreover, multihoming does not mitigate excessive data collection either, clarifying the limits of competition.

\(^{11}\) See Prince and Greenstein (2014) who show that bundling of services can reduce customer churn, i.e. increase switching cost for customers
The approach in this paper is novel as it is the first to apply the concept of shrouding and obfuscation developed by Gabaix and Laibson (2006) to markets with network effects. As privacy issues related to excessive data collection on networks such as social networks or messaging services is heavily debated, the combination of obfuscation and network effects in our model is sensible. Moreover this model provides a perfect framework for further research on data related topics that still need to be addressed. We differentiated consumers regarding their general perception of excessive data collection as dis-utility. The next step would be to differentiate consumers with regards to their expectations on the dis-utility of excessive data collection. Many consumers know that data collection creates a dis-utility but are yet unaware of its magnitude. This could provide important results for consumer protection and consumer information in order to quantify the potential damage resulting from data collection.

The results of our model have important policy implications. Our model shows that competition with regards to privacy settings does not prevent excessive data collection. We deliberately model an entrant that does not collect data, not only to adequately reflect Telegram’s and Threema’s business model but also to impose the most restrictive competitive constraint on the incumbent. In spite of this competitive constraint excessive data collection still takes place. The result thus clarifies that data collection should not be tackled by competition law, as data collection is not the result of a lack of competition. Instead our results suggest that reducing consumer myopia can prevent excessive data collection as consumers would switch to the “entrant” if there were enough sophisticates. We therefore argue for a strengthening of consumer protection laws in combination with regulation and oppose tackling data collection issues through competition law as in the case of the Federal cartel office’s Facebook investigation.

References


