



## THE QWERTY PHENOMENON: ITS RELEVANCE IN A WORLD WITH CREATIVE DESTRUCTION<sup>1</sup>

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**Abstract:** *Does quality always win? Looking at the critical drivers of success in and efficiency of high-tech markets, two contrasting perspectives exist in the academic sector. One camp argues that the higher quality of a product or service exerts a major influence on its market success. Consequently, an inferior market player should not persist. The opposite group emphasises the importance of network effects, which can lead to lock-ins in inferior situations or being stuck in a bad equilibria accordingly, also known as the QWERTY phenomenon. In this paper, we investigate this debate. We demonstrate that the missing consideration of the status quo bias in previous studies leads to the rejection of the QWERTY phenomenon, which means that independent of the quality offered by a business or service the pure moment of who reaches the customer first, establishes a status quo from which it is hardly possible to escape. We give several examples with inferior market leaders. We suggest that this phenomenon causes only temporary harm, and lock-ins could be overcome by Schumpeterian creative destruction. Therefore, we claim that even if lock-ins exist, they pose no problems as innovative market participants have the opportunity to introduce new business models.*

**Keywords:** *platform selection, two-sided markets, status quo bias, QWERTY phenomenon, creative destruction*

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## 1. INTRODUCTION AND RELEVANT LITERATURE

Using a software with low user-friendliness. Typing with a hard-to-learn keyboard. Buying a computer with an expensive operating system although there are free alternatives. There are many situations in which you may ask yourself: How could it happen that such a product or service became the standard and everyone uses it even if more user-friendly, cheaper or general better alternatives exist or existed? And from a social point of view, it is actually inefficient if a standard evolve that is inferior compared to superior products or services of (defeated) competitors. However, subjective and individual experiences with products and services are of course not representative. Rather, the question is if decisions of market participants regularly lead to inferior equilibria.

This question and the above examples are closely related to the so-called QWERTY phenomenon introduced by Paul A. David (1985). In the original context, the reason for ending in an inferior state lies in direct network effects and self-fulfilling expectations. However, the theoretical mechanism that suggests tipping to a single dominant player is comparable. In a market with direct network effects, customers benefit more from a product when other individuals of the same type purchase it as well. The newer two-sided market theory suggests that indirect network effects can also be the reason for a lock-in. In a setting with indirect network effects, there are at least two types of individuals. In such a case, the value of the product (i.e., platform) for one individual increases when individuals of the opposite type choose or purchase it. In both cases (with only positive network effects), coordination on a single platform is a state of equilibrium (Ellison & Fudenberg, 2003; Katz & Shapiro, 1985). If an ex ante inferior platform achieves its lead in the installed base over the superior platform, the externalities can outweigh the inefficiency of this inferior platform. This edge over competitors may be attained by a first-mover advantage (Arthur, 1989) or by chance (Herman, 2001). However, choosing the ex ante superior alternative would be better for society in terms of efficiency. Accordingly, the core question of the debate about the QWERTY phenomenon is how realistic or relevant the possibility of being locked-in in an inferior equilibrium is in real-world situations.

In re-examining David's (1985) case of the QWERTY phenomenon, Liebowitz and Margolis (1990, 1994) find evidence in favour of a possible

superiority of the QWERTY keyboard (Kay, 2013). This means that it is at least questionable whether this eponymous example of this kind of market convergence into inferior solutions describes this phenomenon at all. Liebowitz and Margolis arrive at similar conclusions about other prominent examples of the QWERTY phenomenon (e.g., VHS vs. Betamax).

Tellis, Yin, and Niraj's (2009) study also suggests a limited relevance of the QWERTY phenomenon. In their empirical study of competition in software and operating system markets, they demonstrate that temporarily, there are single dominant players, but no market leader can hold this position over the long term. Thus, in these markets, there are seemingly no lock-in effects. The quality indicators that Tellis and colleagues use suggest that the new market leaders always offer higher quality, which is even more important regarding the QWERTY controversy.

To investigate the case with indirect network effects, Hossain and Morgan (2009) and Hossain, Minor, and Morgan (2011) conducted laboratory experiments. Their participants repeatedly had to choose between two platforms. In all tested settings, the subjects managed to coordinate on the superior platform – even when the inferior platform had a first-mover advantage. Considering their own experimental results, Tellis and colleagues' (2009) empirical study and Liebowitz and Margolis' (1990, 1994) findings, Hossain and Morgan (2009) conclude that the QWERTY phenomenon “lies more in the minds of theorists than in the reality of the marketplace” (p. 440).

However, by reproducing Hossain and Morgan's (2009) experiment with slightly different out-of-equilibrium payoffs, Heggedal and Helland (2014) show that coordination on the superior platform frequently fails under these modified conditions. More recently, using a theoretical model with dynamic competition and customer expectations, Halaburda, Jullien, and Yehezkel (2016) demonstrate that an inferior platform can dominate the market.

In a simulation study of a two-sided market setting, Meyer (2012) also demonstrates that a lock-in in inferior situations may arise under diverse circumstances. He identifies the relative strength of the indirect network effect compared to the difference in quality as important factors for the probability of coordination failure. Strong network effects and small quality differences increase the probability of choosing an inferior platform. Further factors affecting the

probability of an inferior lock-in are (i) the information level of agents (lower or more incomplete information levels increase the probability), (ii) rationality (greater rationality corresponds to a higher probability because in his study, bounded rationality counteracts the indirect network effect) and (iii) successive market entries (coordination on the first mover is likely). Particularly, the last point is driven by the simulation design; the simulated agents (individuals of both market sides) differ in market entry timing. Furthermore, agents do not reconsider their platform choice in each period of the simulation but only after fixed periods of time. In checking this “decision horizon”, Meyer finds that if agents choose their platform in every period, no inferior lock-in occurs (Meyer, 2012).

We highlight this aspect because it reveals a shortcoming regarding the external validity of the experimental studies conducted by Hossain and Morgan (2009), Hossain and colleagues (2011) and Heggedal and Helland (2014). In the context of platform selection, numerous switching between platforms seems to be quite untypical (Lam, 2015). Therefore, to account for this market characteristic, we introduce the status quo bias as a reason why individuals may keep their initial self-selected status quo. We scrutinise how the experimental findings and conclusions may be affected by this bias in favour of the QWERTY phenomenon.

However, Liebowitz and Margolis (1994) and Tellis and colleagues (2009) show that there are hardly any examples for the QWERTY phenomenon over the long term. It seems that a lock-in in an inferior equilibrium causes at least temporary harm. Liebowitz and Margolis suggest that through market dynamics, sooner or later, an inferior product will be displaced by a better one. Beyond these established market-dynamics arguments, we contend that the replacement of one market leader may also follow from “creative destruction”, as described by Schumpeter (2008).<sup>2</sup> In our case, a product is replaced by a more or less similar one that is integrated in a superior business model. In this setting, the higher quality of the examined product is not a necessary condition, but the whole business model of the successor has to be superior. We explain this aspect of superior business models, which is largely absent from the discussion so far, in section 3.

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<sup>2</sup> A second possible view is Christensen’s concept of disruptive technologies (Christensen, 1997). However, we prefer Schumpeter’s broader approach of business development.

The paper extends the prior literature on the debate of the drivers of success in and efficiency of high-tech markets in three dimensions. First, building up on the idea that the business or the service that offers the highest quality will eventually take over the entire market, the QWERTY phenomenon as an academically established concept against this idea is introduced. Strengthening the QWERTY phenomenon by the status quo bias increases the leverage of this alternative concept. According to the status quo bias rather not the highest quality but behavioral and cognitive barriers hinders the superior platform to emerge as the winner. In a second dimension we take Schumpeter's theory of "creative destruction" into consideration. In agreement with his idea we suggest that in the long run new technologies will supersede lock-ins in bad equilibria. This approach offers a reflection of the entire debate and a considerable solution how disruptive forces break up established structures and industries and reshape the economy. Thirdly, the key idea of our approach is the finding that often superior business models are determining the success of new products and rather not the product itself.

In the remainder of this paper, we explain the status quo bias in the context of platform selection. We demonstrate how this bias favours the QWERTY phenomenon and how it could influence the results of the mentioned experimental studies if the authors had designed their treatments in consideration of this bias. By taking this aspect into account, we show that part of the literature is based on an (inadmissible) simplification, so that some of the above mentioned results have no external validity. We then present the Schumpeterian interpretation of breaking up lock-in effects. For this purpose, we give an alternative interpretation of the results of Tellis and colleagues' (2009) study and two further examples that suggest this idea as well. Finally, we draw brief conclusions from our arguments.

## 2. STATUS QUO BIAS

Since it was introduced by Samuelson and Zeckhauser (1988), the status quo bias has received considerable interest from economic, marketing, psychology and political science literature. Substantial research on decision making has repeatedly demonstrated that economic agents do not always choose among alternatives in accordance with well-defined preferences. They extensively use simplifying heuristics and thus often experience a cognitive bias. We suggest that such effects

may also apply when consumers are faced with the decision to choose among different platforms. One of these biases – the status quo bias – describes decision makers' tendency to stick with a given default option when confronted with new options choices (Kahneman, Knetsch, & Thaler, 1991; Ritov & Baron, 1992; Samuelson & Zeckhauser, 1988). This status quo alternative can be set exogenously or as the individual's choice in a previous decision situation (Kempf & Ruenzi, 2006). Evidence from subsequent research reveals that status quo bias can be observed in numerous cases of economic decision making. The methodology that underlies this investigation is quite straightforward.

To arrive at the basic idea of this methodology, we refer to Samuelson and Zeckhauser (1988), who used an experimental setup to test subjects for status quo bias in a sequence of decision scenarios. Using a questionnaire in which subjects faced a set of hypothetical choice tasks, the authors conducted an experiment in the following pattern. In the neutral framing scenario, random subjects were given a set of alternatives, with no alternative labelled as the status quo. These subjects were presented with the following written hypothetical scenario: "You are a serious reader of the financial pages but until recently have had few funds to invest. That is when you inherited a large sum of money from your great uncle. You are considering different portfolios. Your choices are to invest in: a moderate-risk company, a high-risk company, treasury bills, municipal bonds" (Samuelson & Zeckhauser, 1988). In the status quo framing scenario, other subjects were given the same set of alternatives, but one alternative was exogenously labelled as the status quo. In this case, after the same opening sentence, the passage continued: "That is when you inherited a portfolio of cash and securities from your great-uncle. A significant portion of this portfolio is invested in a moderate-risk company [...]. [T]he tax and broker commission consequences of any change are insignificant" (Samuelson & Zeckhauser, 1988). In the investigation of different scenarios, all using the same basic experimental design, the results implied that an alternative became significantly more popular when it was labelled as the status quo. A significant status quo bias was demonstrated in 31 out of 54 cases (Samuelson & Zeckhauser, 1988).

Similar findings can be observed in the decisions about which electricity contract to choose from several options (Hartman, Doane, & Woo, 1991), which car insurance to select (Johnson, Hershey, Meszaros, & Kunreuther, 1993), being an

organ donor or not (Johnson & Goldstein, 2003) and which one to pick among different retirement plans (Madrian & Shea, 2001). Existing studies of status quo bias have proposed numerous explanations for how the status quo affects choice. For instance, the loss aversion theory (Tversky & Kahneman, 1991) assumes that the status quo serves as a reference point, and losses relative to the reference point have greater impact on preferences than gains. The inertia theory (Ritov & Baron, 1992) presupposes people's preference for inaction; maintaining the status quo requires no additional effort and is the easy option. The decision avoidance theory (Anderson, 2003) assumes that people are inclined to make no decision, especially when they have to choose from many options. The incomplete preference theory (Mandler, 2004) combines the status quo bias with the traditional consumer theory by proposing that people with an unchanging but incomplete preference tend to keep the status quo because to their knowledge, their choice is currently the best. Boxall, Adamowicz, and Moon (2009) conducted two separate choice experiments to examine the respondents' tendency to choose the status quo when faced with high complexity (increasing number of alternatives per choice task) in choice. They demonstrated that increasing complexity leads to increased choice of the status quo.

Taking all these explanations into account, the status quo bias could be categorised as the consequence of (1) rational decision making in the presence of transition costs and uncertainty, (2) cognitive misperceptions and (3) psychological and emotional commitment (Camerer, Issacharoff, Loewenstein, O'Donoghue, & Rabin, 2003; Samuelson & Zeckhauser, 1988). Our study focuses on the first category and takes up Samuelson and Zeckhauser's brief mention of the QWERTY phenomenon – “more efficient alternatives seem to have little chance of replacing the classic typewriter keyboard” (p. 34). The results of Hossain and Morgan's (2009) study about the dynamic platform competition led them to conclude that the subjects did not get stuck on the inferior platform, stating that “the quest for QWERTY in the lab proved utterly fruitless” (Hossain & Morgan, 2009). Somehow referring to the phenomenon of the status quo bias and not considering any existence of it, their conclusion strongly contrasted with previous research findings about the status quo bias. Using Hossain and Morgan's (2009) 60 iterations of somewhat rudimentary binary choice tasks between a superior and an inferior platform in the absence of any transaction and/or opportunity costs would produce such outcomes.

In a recent study, Geng (2016) designed a series of laboratory experiments in which the subjects chose among objects of fixed monetary value, expressed in addition and subtraction operations. The subjects were incentivised to seek the alternative that had the greatest value within a given time frame. Building on the work of Caplin, Dean, and Martin (2011), as well as of Gabaix, Laibson, Moloche, and Weinberg (2006), Geng's experiments tried to make evaluating alternatives more cognitively costly, and the subjects must expend their efforts to do so. Geng reports that decision makers fail to select an object that is better than the default 28% of the time. Geng's (2016) findings, the modified experimental settings from Heggedal and Helland (2014) and Meyer (2012) challenges the results of Hossain and Morgan's (2009) study. These results show that following technological developments, the leadership changes that are observed in numerous markets for platforms (e.g., software and operating systems, Internet browsers and video game consoles) may not inevitably produce outcomes in which higher-quality platforms win. A systematic implementation of the considerations mentioned above might have led to different results. Given all this evidence, the assumption that decision makers exhibit a significant status quo bias when faced with a series of simple hypothetical choice tasks is quite likely. According to the rational choice model, subjects should simply select their most preferred alternative when facing a decision. However, the presented findings suggest that subjects are somewhat biased by an exogenously pre-existing status quo option and do not act in a completely rational manner in choice situations. Based on all this empirical evidence, we conclude with Kahneman and colleagues' (1991) statement, as follows: "We have become convinced that [...] status quo bias [...] [is] both robust and important" (p. 205). Having established that status quo bias could be present when consumers are confronted with platform selection decisions, we want to more closely examine the Schumpeterian interpretation of market development and how lock-in effects might be broken up.

### **3. SCHUMPETERIAN INTERPRETATION OF MARKET DEVELOPMENT**

In the previous section, we have offered arguments favouring the QWERTY phenomenon. Despite these considerations, permanent lock-ins are hardly found in markets (in neither inferior nor superior situations). According to Liebowitz and Margolis (1990, 1994), retaining an inferior platform in the presence of a better



alternative means not using profit opportunities. These profit opportunities should offer the owner of the superior platform an incentive to capture the market, even if the owner had to share some switching costs that the customers of the incumbent would have to incur (Liebowitz & Margolis, 1994). Obviously, the higher the quality differences are, the higher the incentives are for a potential newcomer. Tellis and colleagues' (2009) findings about software and operating system markets apparently echo this "quality-wins argument". Gretz (2010) analyses the home video game market with a similar scientific problem formulation. In his paper, he also finds evidence for the major significance of quality. Based on Gretz's (2010) study, Gretz and Basuroy (2013) investigate this question once again, considering the home video game console's life cycle. With this more sophisticated approach, they identify periods in the product life cycle (growth and maturity phase) in which network effects are more important than quality.

Besides these conflicting results, the quality measurement poses another more fundamental problem. For the 32–64-bit era in the home video game market, Liu (2010) suggests that the Nintendo 64 is of higher quality compared to PlayStation. In contrast, Dubé, Hitsch, and Chintagunta (2010) find evidence in favour of PlayStation's quality superiority. Gretz (2010) and Gretz and Basuroy (2013) use a quality measure solely based on hardware components (e.g., central processing unit speed). For their study, Tellis and colleagues (2009) include these hardware aspects in their quality definition, too. Furthermore, they use some "softer" indicators such as "ease of use", collecting this information from consumer and computer magazines. This approach comes with two restrictions. On one hand, the subjective evaluation by the writers of these magazines may be problematic; on the other hand, a measure of quality may not consider all relevant factors.

For any empirical study in this field, it is obviously necessary to choose a useful measure of quality, but inconsistent or subjective measures may lead to conflicting conclusions in the "quality-wins" debate. However, an *ex post* analysis, as applied by Liebowitz and Margolis (1990, 1994), which suggests coordination towards superior outcomes, depends on a correct measure of quality. Otherwise, the main findings could change with every improvement in empirical methods or accuracy.

Our understanding of competition, in which "creative destruction" breaks up lock-ins, does not involve higher product or platform quality as a necessary

condition (even though the products might have higher quality). The most important point is to recognise that an isolated view on a single product of a multi-product company is misleading when such a company operates an overall strategy.

Following (Schumpeter, 2004) argument, “real” economic development only arises when economic players develop “new combinations” of production factors in a novel manner. These discontinuously appearing incidents of economic activities fundamentally affect equilibria and lead to structural changes. Incumbent providers of goods and services may exit the market due to their lost competitiveness. Schumpeter (2008) coined the term “creative destruction” for this process. The following examples emphasise that such a process might be the reason for breaking up lock-ins although the original product remains. Our argument’s main point is that innovative business models can eliminate the old ones and fundamentally change the equilibrium position. Surprisingly, hardly any attention has been paid to the importance of business models in the academic discussion on the lock-in effect and the QWERTY phenomenon. The following examples show that there are prominent cases where our business model approach is helpful to better understand the relevance of the QWERTY phenomenon.

### **3.1. Software and operating system market**

Table 4 of Tellis and colleagues’ (2009, p. 143) article presents an overview of the switches in the market share leadership of the objects under investigation. It is striking that nine of the 17 analysed examples are Microsoft products or services, with Microsoft replacing the market leader in each case. Apart from the personal finance software market, Microsoft is absent in the remaining eight investigated markets, which are therefore not in the main scope of Microsoft’s business model. Tellis and colleagues (2009) argue that the higher quality of every single product is the main driver for the market share leadership switches in the corresponding partial markets.

Following our approach to creative destruction, these findings suggest that it is Microsoft’s complete package – comprising its operating system and complementary, mutually compatible software – that has been able to break up a potential lock-in. This has resulted in Microsoft becoming the new market share leader. Selling PCs with the Windows operating system and frequently preinstalled software has helped penetrate the market. With every sold PC with Windows,

Microsoft creates a default option (status quo) for each customer. It could be assumed that Microsoft uses this hardware–software bundle in a targeted manner, thereby eliminating the time-consuming search for alternative software. Beyond this, increasing diffusion leads to stronger network effects. In summary, this bundling strategy has become a competitive advantage over rivals that focus on their stand-alone software. Obviously, Microsoft’s superior overall strategy has overcome other established business models. At least for the affected markets, this bundling strategy represents a new combination of already existing factors, with a huge impact on the market structure and possible business models. Hence, Microsoft’s successful activities in its targeted markets can be called acts of creative destruction.

However, Tellis and colleagues (2009) highlight the counterexample of the unsuccessful software Microsoft Money and deduce that the leadership of the other Microsoft products and services does not result from embedding them in the overarching Windows platform. They conclude, “The failure of Microsoft Money to dominate Quicken shows that even such bundling power fails to swamp the effect of quality” (p. 148). Certainly, Microsoft Money does not seem to fit in our approach. The same holds true in the case of Google Chrome overtaking the market share of Microsoft’s Internet Explorer in 2012 (StatCounter, 2016). Nevertheless, Microsoft has redefined the business, and the failure of Microsoft Money has obviously not been crucial for its overall corporate success. Microsoft Office retains a vast market share, and we doubt that Word, Excel, PowerPoint and Co. would have reached this position as stand-alone software without Microsoft’s overall strategy. This does not mean that Microsoft will inevitably hold this position permanently. The development in the Internet browser market demonstrates that another innovative company with a good (or even superior) concept may in turn replace the market leader. We discuss this example, *inter alia*, in the next subsection.

### **3.2. The rise of Google**

Founded in 1998, Google is another example of a company that has captured several markets through a revolutionary new business model. We do not present Google’s whole history but highlight some aspects that echo our interpretation of competition. Google began solely as a search engine with high quality (PC-

Magazine, 1999). Due to its quality and cooperation with strategic partners,<sup>3</sup> Google gained the market share leadership, defeating Yahoo!, AltaVista and others (Wall, 2015). Shortly after its market launch, Google built up its business on advertisements, essentially based on the combination of Google AdWords (launched in 2000) and Google AdSense (launched in 2003) (Wall, 2015). These two tools allow advertisers to place content-targeted advertisements. Furthermore, since 2009, Google has offered preference-targeted ads on partner websites and their own websites, such as YouTube (Google, 2016a). In summary, Google does not depend on selling a particular product or service to consumers but offers an attractive platform for advertisers; Google's attractiveness depends on the number of users, specifically, large target groups for the advertisers. This is a typical case of indirect network effects; the platform value for one group (the advertisers) increases with the number of other platform participants (the search engine users). Considering Google's further activities, offering several free products and services, it seems that it has been aware of such effects. Some examples that demonstrate Google's efforts to bind consumers to become attractive for advertisers are Gmail (email service since 2004), Google Maps (map and satellite images, route planning and GPS Navigation since 2005), YouTube (video content platform since 2006), Android (mobile operating system since 2007) and Chrome (web browser since 2008) (Google, 2016b). The list could be continued, but it is important to note that in Google's business strategy, these initiatives are necessary to earn revenues from advertisers. Further examples are Yellow Books' (independent Yellow Pages publisher) policy of offering advertisement for free in the first year it enters into a new city and Adobe's free distribution of Reader. Both strategies have established a technological standard that will generate usage, which companies can capitalise on in the future (Rysman, 2009).

However, we have already mentioned that Google Chrome became the market share leader in the web browsing market in 2012. To understand how Google broke up this lock-in, its overall strategy should be examined once again, comprising the following aspects: (1) Its market share leadership in the search

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<sup>3</sup>Google became AOL's search partner in 1999 and paid several million dollars to Mozilla and Adobe, for example, to be their default search engine or to implement the Google Toolbar in their software (Wall, 2015).

engine platform enables Google the opportunity to advertise for Google Chrome. (2) Chrome is preinstalled and the default web browser on most Android devices (smartphones, tablets and notebooks). (3) Chrome is optimised for other Google web products (e.g., Google Docs). Furthermore, Chrome regularly reaches high positions in web browser rankings (Tripp, 2016). Chrome's high quality likely follows from Google's financial and human resource capacities and programming knowhow. Therefore, Google's browser should not be viewed in isolation from Google's other products or from the overall strategy. In summary, Google's position in this partial market can be explained with its efficiently performing business concept.

Microsoft's Internet Explorer and other web browsers have survived the emergence of Chrome. Google's activities have larger impacts on other markets. For example, since Google Maps' launch, it has become difficult for traditional commercial map providers to sell their products. Google offers maps to consumers for free.<sup>4</sup> Consequently, for many users, fee-based cartographical materials have become obsolete or may be worse alternatives in the view of many customers. Google's free services such as Google Maps are possible because of their advertisement-financed approach; at the same time, these services are necessary to earn revenues from advertisers. Google's success suggests that this innovative approach works better than the business models established until then. There are competitors of Google Maps, but most of them pursue a similar strategy – offer a free service to earn money from something different. In our opinion, this example demonstrates once again how creative destruction works and reshapes complete branches.

### **3.3. Competition among home video game platforms**

The history of home video games in the US comprises numerous interesting events and developments for our investigation. First, the market for portable systems (handheld devices) demonstrates that a superior system can be defeated by a worse rival product. Nintendo and Atari released their handhelds, Gameboy and Atari Lynx, respectively, at almost the same time (Herman, 2001). The original Gameboy featured an under two-inch square monochromatic screen without a

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<sup>4</sup>The limitations are stated in its terms of service (Google, 2016a).

backlight. On the other hand, Atari Lynx had a backlit, slightly larger colour screen; thus, its users were able to play games without an extra light source required to play games on Gameboy. Moreover, Atari Lynx was powered by a 16-bit processor, way faster than Gameboy's 8-bit processor. Although Atari Lynx had a higher introductory price (\$149 vs. Gameboy's \$109), needed two more AA batteries and weighed a bit heavier, it seemed superior to Gameboy. However, due to a delivery shortage, Atari Lynx missed the 1989 Christmas season (Herman, 2001). Gameboy thus captured the market share leadership and held this unchallenged position for several years despite its technical inferiority. The main reasons were the large number of available games (especially some very popular blockbuster games such as Mario Bros. and Pokémon) and the huge user base, in other words, the indirect network effects (Herman, 2001). Numerous competitors tried to establish a portable system besides Gameboy. Many of these had higher quality (e.g., Atari Lynx, Atari Lynx II, Sega Game Gear and SNK NEO Geo Pocket), but all failed to break up Nintendo's dominance in the handheld market. It required remarkable technical progress (Nintendo Gameboy Advance, Sony PSP) or an innovation that introduced consumers to a new kind of game play experience (Nintendo DS) to overcome Gameboy's market position (Forster, 2013).

The market for home video game consoles is a more turbulent case. This market has experienced enormous technical development, from processing eight bits of information in the mid-1980s to 128 bits at a time in the most recent systems. Developments in the processing speed of video game consoles and the associated programming techniques explain the improvements in graphic quality and play experience (Rysman, 2009). However, our study shows that it is not quality or network effects that inevitably lead to success but superior business concepts that include these points. Besides, timing and luck can be important factors as well. In a brief overview of part of this history, we highlight incidents and developments that echo the significance of our holistic business concept approach.

The first generation of home video game consoles in the 1970s had a fixed number of built-in games (Herman, 2001). Typically, these games were the popular ones known from arcade centres. Magnavox's Odyssey, the first home video game console, featured several hard-coded games. Users had to switch circuit boards and plastic overlays for the TV screen to choose which game to play and to display the graphics. Other manufacturers offered video game consoles that had only one

game. Atari's Pong was particularly popular; hence, various Pong clones by different manufacturers entered the market. Among these clones, Coleco's Telstar was quite successful for two reasons. First, its low retail price and second, a chip shortage led to Coleco being the only manufacturer that was able to produce its planned supply (Herman 2001). This incident is comparable to the case of Gameboy vs. Atari Lynx. However, in 1976, Fairchild introduced its Video Entertainment System (VES, later renamed Channel F), the first console that used game cartridges. This innovation enabled owners to just buy these cartridges instead of new consoles if they wanted other games. This superior system rendered the dedicated systems obsolete and initiated the second generation of video game consoles that lasted till 1983.

Not long after, several companies (Atari, RCA, Fairchild, Magnavox, Coleco, Bally and Mattel) offered cartridge-based consoles. Between 1977 and 1980, Bally's Arcade was considered the console that delivered the best graphics. However, it suffered from two disadvantages; it cost \$100 more than Atari's VCS (in 1982, renamed Atari 2600) and only had a few games available (Herman, 2001). In contrast, Atari offered the largest number of games and strived to include some popular titles in its portfolio. For this reason, Atari licensed and ported Taito's arcade blockbuster "Space Invaders" for home use, the first time that a third-party game had been made available for home video consoles (Herman, 2001). In 1980, Mattel released Intellivision, a console that convinced customers for two reasons. First, it had outstanding graphics. Second, Mattel licensed trademarks such as NFL and NBA to give games some kind of "official touch" (Herman, 2001). With these two new aspects, Mattel gained the second highest market share behind Atari despite its comparatively small library of games.

However, up to that time, Atari had sold approximately two million VCS units (Herman, 2001). Since all companies earned most of their revenues from the sale of cartridges, a new company, Activision, decided to offer games for VCS to earn some money, too (Herman, 2001). Because of its much smaller installed base, Activision did not offer games for Intellivision. Activision's games were innovative, challenging and had better graphics than Atari's games because Activision optimally used the VCS capabilities. Atari's VCS sales volume profited from Activision, while Mattel's Intellivision lost market share. However, the superiority of the Activision games also meant that Atari itself sold fewer

cartridges. Therefore, Atari unsuccessfully tried to forbid Activision from selling VCS-compatible cartridges through an injunction (Herman, 2001). Motivated by Activision's success, other software-only companies were founded to offer games. With the market entries of the game developers, a textbook example of a two-sided market emerged. Due to the indirect network effects, most third-party game developers limited themselves to games for VCS. Just a few third-party games were developed for other consoles. Consequently, VCS became more attractive for customers and became the unchallenged market share leader. Mattel and Coleco introduced two new consoles, Intellivision II and Colecovision, respectively. Compared to Atari's VCS, both were technically superior. However, Mattel and Coleco recognised their inability to defeat the VCS-favouring network effects. Therefore, they offered adapters so that all VCS cartridges could be played on their respective consoles (Herman, 2001). For its part, Atari released the Atari 5200, which offered technical quality comparable to those of Intellivision II and Colecovision and was able to play VCS games as well.

Despite these new superior consoles, Atari's VCS was still the bestseller. Its success obviously lay in the importance of the game availability, in other words, the indirect network effects. However, Atari failed to internalise the network effects properly. A misunderstanding of the new market structure could explain why it tried to rule out third-party developers such as Activision. In any case, Atari did not manage to profit from these new market participants. Quite the contrary, Atari lost revenues due to the new competitors in the software market. Although this competition boosted the VCS sales volume, it was also the reason why the game console market collapsed in 1983–1984. The market was oversaturated with video games; customers could not distinguish the good from the bad ones. On the other hand, many companies left the market because they were no longer able to earn enough profits. It seems that the indirect network effect from game developers to console users became negative.<sup>5</sup> Moreover, there was a congestion effect on the developer side. Overall, these factors suggest that Atari's business model was not suitable to handle the new environment.

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<sup>5</sup>More games decrease players' overall platform utility. In another context this phenomenon could be found with similar results (Iyengar & Lepper, 2000; Schwartz, 2004)



This was Nintendo's time to break up Atari's dominance. When Nintendo entered the US console market with its Nintendo Entertainment System (NES) in 1985–1986, it was well aware of the developments that caused the market collapse and adjusted its business model to avoid similar problems (Herman, 2001). Obviously, Nintendo knew that the value of its console significantly depended on the number of available games and that third-party developers constituted the fastest way to acquire games for the console. Therefore, Nintendo allowed third-party companies to produce games for the NES. However, to avoid a renewed flood of (inferior) games, third-party companies needed a licence from Nintendo to produce games for it. Furthermore, all game cartridges were produced by Nintendo itself and had a lockout chip inside, which ensured that solely original, licensed cartridges could be played on the NES. Additionally, Nintendo raised the royalty per sold cartridge from the third-party companies. Nintendo put its seal of quality on each cartridge box to show customers that Nintendo games had to meet quality standards. In summary, it seems that Nintendo's strategy involved a conscious decision with regard to the network effects. In 1986, other consoles were released in the US (e.g., Sega Master System, Atari 7800). Critics insisted that the Sega Master System was superior in terms of graphics and playability (Herman, 2001), but the sales volumes of all Nintendo competitors were small. Therefore, hardly any third-party companies developed games for these rival consoles. Even the 16-bit systems, which were introduced in 1989 (e.g., NEC TurboGrafx, Sega Genesis) and offered much better graphics and speed, were outsold by Nintendo's 8-bit NES (Herman, 2001).

In the Christmas season of 1993, Sega gained a small victory in the 16-bit market against Nintendo's 16-bit successor of the NES (the Super NES) and sold more consoles than the competitors. However, it took some time, until the 32–64-bit era, to really overcome Nintendo's dominant position. To shorten this phase, we only highlight some of the main reasons why a new competitor, Sony's PlayStation, captured the market share leadership during this period. First, Sony seemed to be the first company that really took the structure of the indirect network into account. Sony pursued the so-called "divide-and-conquer strategy", selling consoles at a cheap price (at a loss) to earn profits from the software side (Herman, 2001). Sony's second advantage was in making it easy for third-party companies to develop games for the PlayStation. Sony allowed developers to use its huge library

of codes and routines, reducing the development time for a PlayStation game, much shorter than the necessary time for a comparable Saturn (Sega) or N64 (Nintendo) game (Herman, 2001). In addition to the user base, this was an incentive for third-party companies to develop games for Sony. Thus, the PlayStation became the console with the largest number of available games. However, Sony used Nintendo's approach. Each third-party company needed a licence to release a game for the PlayStation. This restriction was supposed to ensure Sony's standards of quality. Another strategic move by Sony was the Yaroze, a special version of the PlayStation for non-professional game developers. This console was delivered with a toolkit that allowed the owners to develop their own games, play these on their consoles and upload them on a special website. Other Yaroze owners were allowed to play the uploaded games, too, increasing the amount of available games in a controlled manner (Herman, 2001) and binding users to Sony's console. Furthermore, Sony obtained the first right of refusal for the uploaded games so that it was able to monetise any innovative game that a Yaroze owner created.

Although Nintendo's N64 was released about one year after the PlayStation, it earned respectable sales figures and overcame Sega's market share (Herman, 2001). One main reason for Nintendo's success involved some very popular games, especially Super Mario 64. However, the N64 lacked third-party games because developers preferred Sony's larger installed base and the cheaper production costs of PlayStation games.<sup>6</sup> Ultimately, Nintendo failed to prevail against Sony's superior strategy to profit from the two-sided market structure.

We briefly summarise the preceding discussion to clarify our point. The first generation of home video games showed that good games (Atari Pong) or luck (Coleco's Telstar) were reasons for success, but (as Fairchild and others demonstrated) it was easy to replace these companies with the superior, cartridge-based consoles. Atari's market share leadership indicated that quality was not the most important aspect in the market of the second-generation consoles. Otherwise, Bally should have won until Intellivision II and Colecovision were introduced. However, Atari's strategy to profit from the importance of available games seemed superior. Obviously, Atari's business model could not prevent the market collapse

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<sup>6</sup>The PlayStation used CDs, which were much cheaper than the N64 cartridges (Herman, 2001).

in 1983–1984, but this shakeout enabled Nintendo to capture the market share leadership. Nintendo's approach was a clear advancement because it considered both sides of the market simultaneously. Consequently, Nintendo was able to protect its leadership over the competitors' superior consoles. Significant technological progress was necessary for Sony to break up the "Nintendo lock-in". Sony's strategy simply internalised the network effects better. It is questionable if the lock-ins would have been broken up without the market collapse and technical progress. Nevertheless, Nintendo's and Sony's high-performing business concepts were at least necessary to initiate a new generation of video game consoles.

#### 4. CONCLUSION

Are Hossain and Morgan's (2009) and Liebowitz and Margolis' (1990, 1994) conclusions right? Does the QWERTY phenomenon just lie "in the minds of theorists", and will superior products, platforms or standards always win? We do not think so. In general the laws of demand and supply work. However, our examples suggest many markets with (at least) temporary lock-in situations. The status quo bias is a well-known phenomenon that can explain why these lock-ins may evolve. Of course, there might be further reasons, but the missing consideration of the status quo bias could be responsible for the definite results and conclusions presented in the experimental studies conducted by Hossain and Morgan (2009) and Hossain and colleagues (2011). In line with both results from field and laboratory experiments we demonstrate that research on the QWERTY phenomenon and possible lock-ins in bad equilibria expands the scope of inquiry and adds more empirical explanation by introducing the status quo bias.

Furthermore, the case of the home video game market clearly demonstrates that quality does not inevitably win. It is also important to mention that an inferior winner is not necessarily associated with a first-mover advantage. For example, Sega's Dreamcast was considered the superior console in the sixth generation, and it entered the market first. Nonetheless, it was defeated by Sony's PlayStation II and Microsoft's Xbox (Herman, 2001). The case of the home video game suggests that network effects are important. Inferior situations with dominant market share leaders in the presence of better alternatives are possible.

The three examples we have cited also demonstrate the innovative or superior business concepts' ability to break up lock-ins, which is compatible with a

Schumpeterian interpretation of market development. In the case of the home video game consoles, technological progress or market shakeouts seem to be important. However, the market shakeout after the second-generation console appeared unavoidable; Atari's business strategy failed to manage the new circumstances after Activision entered the market. Nintendo's strategy was necessary to account for the two-sided market structure. Microsoft and Google overcame the leaders due to their superior business models and high or at least sufficient quality. The question remains open whether the QWERTY phenomenon is a problem in reality. Our answer is that it depends on the context: In the short term, people may observe a superior platform losing to an inferior one. Given such a short-term view, it is reasonable to call this a market failure. If a longer period of observation is considered, the situation changes. First-mover advantages and/or network effects and/or luck can lead to inferior lock-ins, but these can be overcome with innovative ideas. That means, while in the past due to a lack of available information or barriers to overcome the transaction costs of the given status quo, first movers' were protected from possibly better competition, these shelters are increasingly repealed due to global digitalisation. In the age of digitalisation, these established structures and industries are breaking up and are reshaped by disruptive forces so that only one or a few best providers will remain.

Superior products constitute the essential reason in Liebowitz and Margolis' (1990, 1994) argument. However, the experimental and empirical studies favouring their contention are not entirely convincing. We think that the experimental studies lack essential factors. We have introduced the status quo bias as one example of an important but untested factor. Consequently, these studies seem to have no external validity. The empirical studies suffer from contradicting results and a problematic measurement of quality. Moreover, the anecdotal evidence offered in our examples depicts another picture – quality does not always win.

Undoubtedly, there are switches in market share leaderships. We argue that some kind of Schumpeterian creative destruction – focusing on the superiority of the new market share leaders' business strategies – may have caused the switches in our examples. We do not see an alternative to ex post analyses to check this interpretation, and we are aware of the shortcomings of anecdotal evidence.

Breaking up an inferior market share leadership regulation could be one possibility. However, in a regulated market, potential innovators can be negatively

affected as well. The decision-making scope is limited. It is possible that innovations do not occur at all because companies cannot implement new strategies. For instance, if the price-setting freedom is restricted on at least one side of a two-sided market, a divide-and-conquer strategy is not possible. Nintendo's and Sony's market entries would not have been possible in the way these have been described in the previous section. Furthermore, this restriction typically leads to less profits of the market share leader. Market entrance incentives are missing. Consequently, potential innovators are confronted with high risks and low profits and forego the opportunity to participate in the market. A new superior product may be unavailable to customers, and persistence in the current state can be caused. Therefore, a broader view of competition should be considered before market interventions are implemented.

If we are interested in efficiency, it may be wrong to dispute whether the better or worse product or service is the current standard. As we have shown, measuring quality is problematic. A valid judgement could often only be reached when the problem no longer existed. Certainly, there are frequently comparatively poor solutions as standard. However, already several years ago Schumpeter argued how entrepreneur-spirit can shake up equilibria. In line with his idea, we suggest that having an innovation-friendly environment should be one of the most appropriate ways to break up lock-ins. And this innovation-friendliness must explicitly include business model innovations, because innovative business models can facilitate profit opportunities that superior products alone do not necessarily have.

Given the fact that digitalisation in general and platform markets in particular have tendencies for monopolisation or "QWERTY situations" respectively, our study gives insights for question how to deal with these cases.

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