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The cost of switching Internet providers in the French broadband industry, or why ADSL has diffused faster than other innovative technologies [*]

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Abstract

The paper focuses on the innovative French broadband Internet industry that is characterised by inertia phenomena in terms of technology choice. We argue that although inertia on the supply side helps to explain the faster diffusion of ADSL, a more complete picture can be obtained when we consider the existence of costs faced by customers when switching between Internet Service Providers (ISPs). We calculate these so-called "switching costs" and conclude that they act as a barrier to customers' mobility, thus bringing about a dominance of the technology supplied by the largest firm.

Keywords: consumers' switching costs, technological inertia, evolution of industries.

JEL Classification:L11, L86, 033.

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1 Introduction

The Lisbon Strategy explicitly set the goal of making Europe the most successful knowledge-based economy by the year 2010. Of particular importance to this is the enhancement of knowledge-intensive sectors such as the ICT (Fagerberg and Verspagen, 2002). Within ICT, the Internet industry is often considered a test field with respect to the goal of reducing the digital divide (Downes and Greenstein, 2002). With this in mind, a new legal framework has been elaborated for Broadband communications markets, implemented by a series of European directives in 2002, with the purpose of guiding member states and their national regulatory authorities as they act. While the desired outcome is to foster and consolidate competition in markets, we can already observe today some important shortfalls between such political claims and the current dynamics of info-communications in Europe. This paper explores these shortfalls by focusing on the French broadband industry.

The relatively short history of the broadband industry in France (appearing first in the early 2000s) provides however a solid basis for an economic analysis and actually identifies an important paradox. Although broadband Internet can be delivered by a number of different competing technologies, among these one largely dominates the industry. In 2005, 72% of end-users were connected via DSL technology; 16.5% used Wifi, which is often considered as an advanced technology since it provides wireless access; and 4.5% used cable, the initial broadband technology. In addition, whereas entry has been generally encouraged by the French regulatory authority (Arcep), the incumbent operator France Telecom (FT) still enjoys the lion's share of end-customers: market share in 2005 stood at 51.5%, relying exclusively on DSL-based technology.

Widely innovative and competitive, the French broadband Internet industry is undoubtedly characterised by important inertia phenomena in terms of choice of technologies, and also in terms of providers. This is problematic since one of the expected consequences of the emergence of the innovation 'broadband Internet' in France was the creation of real competition between technologies. What was intended, especially from the regulators' viewpoint, was a decisive contest between the incumbent's choice of technology (DSL) and alternative technologies (such as cable or Wifi) supported by new entrants providing high quality packages at cheaper prices.

Industrial dynamics provides key elements in the analysis of inertia where supply sources are concerned (Malerba, 2002; Klepper, 1997; Krafft, 2006a). As such it provides a potential explanation for why, despite a regulated competition process that encouraged companies to select the best technology and related services at the lowest price, the dominant company (here FT) was finally able to impose the development of DSL as the standard, despite it being neither the optimal nor the initial technology[1]. This paper aims to analyse the causes of the inertia affecting this industry, by investigating both supply and demand factors. We argue that although inertia on the supply side does help to explain the current situation, a more complete picture of the industry dynamics is only obtained when we introduce the costs – the so-called "switching costs" – faced by customers wishing to change Internet provider. Thus, though largely neglected in most of the industrial dynamics approaches, this source of inertia on the demand side is paradoxical but nevertheless crucial in the broadband industry. Paradoxical, since it is commonly said of demand for Internet connection and services that consumers have access to all information about service providers, both in terms of costs and efficiency of service. Crucial, since we demonstrate that the presence of switching costs helps to explain why the incumbent – and hence its technology – are dominant[2].

The role we ascribe to consumers in explaining technological inertia differs from the overwhelming majority of papers which follow the literature on network externalities pioneered by Katz and Shapiro (1986). In the literature we have followed it has been

[1] For an interpretation in terms of systems of innovation in the line of Antonelli, 2003; Pavitt, 2001; Metcalfe, 1995; Freeman, 2002; Nelson and Nelson, 2002; Lundvall et al., 2002, Mowery and Simcoe, 2002, see Krafft, 2004, 2006b.

[2] A series of papers (Suarez, 2004; Murmann and Frenken, 2006) has recently proposed an integrative or systematic framework for understanding the process by which a technology achieves dominance when battling other technological designs. Our perception, in the case of the French broadband industry, is that the level of switching costs that we measure impedes the adoption in a short time span of competitive and advanced technologies, reinforces the credibility of the incumbent with the largest installed base, discards cheaper pricing strategies, and perverts regulation frameworks. All these points are discussed in the paper.

shown that large values for switching costs on the consumers' side can lead to the adoption of inferior technologies (see Shy, 2002a and references therein; Beggs, 1989). Together with sunk costs of entry, switching costs generate an *indirect* network externality (see Liebowitz and Margolis, 1994, for a discussion of the differences between direct and indirect network externalities). Basically, a retail firm's customer does not directly obtain higher satisfaction as the total number of consumers switching to the same technology increases. Rather, the consumer cares about the number of other consumers subscribing to the chosen retailer, since this factor increases the likelihood it will survive in the industry.

In the next section, we give an overview of the broadband industry in France (Section 2). We then show that in order to understand the dynamics of the broadband industry, it is necessary to consider both supply- and demand-side determinants of DSL's dominance (Section 3). We argue that inertia on the supply side (that is, imitating the incumbent in choosing DSL, reluctance to introduce the novel Wifi technology, and distortion of competition in cable) provides only a partial vision of the dynamics broadband industry in France. Yet, inertia on the demand side lies in the presence of significant consumer switching costs which are empirically measurable from actual data on prices and market shares (Section 4). We define customer switching costs and calculate them using Shy's quick and easy measure (Section 5). Finally we comment on our results and present our conclusion (Section 6).

2 Broadband in France

2.1 Non-DSL technologies lag behind

Broadband communications have become the most important focus in the current evolution of the Internet (Fransman, 2006). Broadband generally means Internet connections of a speed superior to 128kbit/s. Broadband Internet can be provided via different technologies – DSL, Cable and Wifi – none of which can be considered as emergent. Of these, DSL (or ADSL for asynchronous digital subscriber line) have diffused faster. Developed in the late 1980s, this technology allows broadband data to be sent over the traditional copper telephone lines that connect most homes and small businesses. It has rather naturally become the incumbent operator's choice of broadband technology because it also owns and controls the copper telephone lines. Cable is an earlier technology that initially attracted a large portion of consumers. Invented and in use by the late 1970s, cable has long been considered as a major infrastructure for the supply of telecoms services requiring high speed. Since 1998, cable networks and co-axial cables, used for cable TV, have been used, together with cable modems, to provide broadband communications and were developed all over the country by cable operators that compete with the incumbent on the local loop access. Today, however, the population of end-users using this technology is stagnating. Wifi is an advanced technology invented in the mid-1990s which allows an over-the-air high speed connection to be made between a radio-enabled client (equipped, for example, with a laptop) and a base station connected to the local access network. Firms specialised in this technology avoid the use of local loop access which is generally controlled by the incumbent, that is, which corresponds to the incumbent's wire line infrastructure. The number of end-users of this technology is increasing, though at a slower rate than might be expected for an advanced technology.

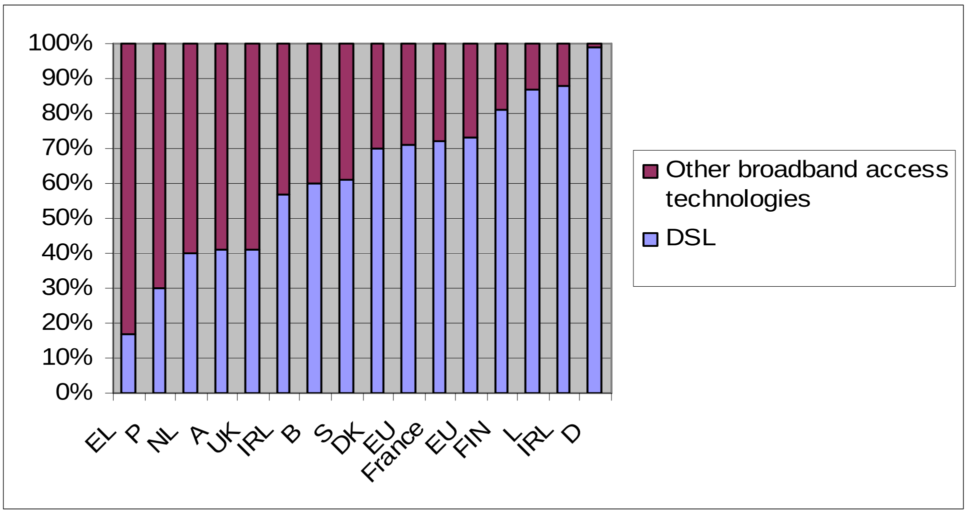

Fig. 1. Breakdown of technologies used for broadband access in European countries (source: Arcep, 2004 and 2005)

DSL technologies also take the lead in wider Europe (see Fig. 1). In France, as in half of the European countries, non-DSL technologies still account for a very low share of the market. In France, 72% use DSL and alternative technologies 28%.[3] Annual reports from Arcep show that in 2004 only five countries (including the UK, the Netherlands and Austria) out of 15 rely on non-DSL technologies as a major source for broadband access. This can be interpreted as DSL domination, and furthermore, that at the end of the day competition from other technologies is not so great in France or most European countries.

2.2 Firms' market share and prices

France occupies an intermediate position in the distribution of incumbent versus new entrant market share in Europe (Fig. 2).

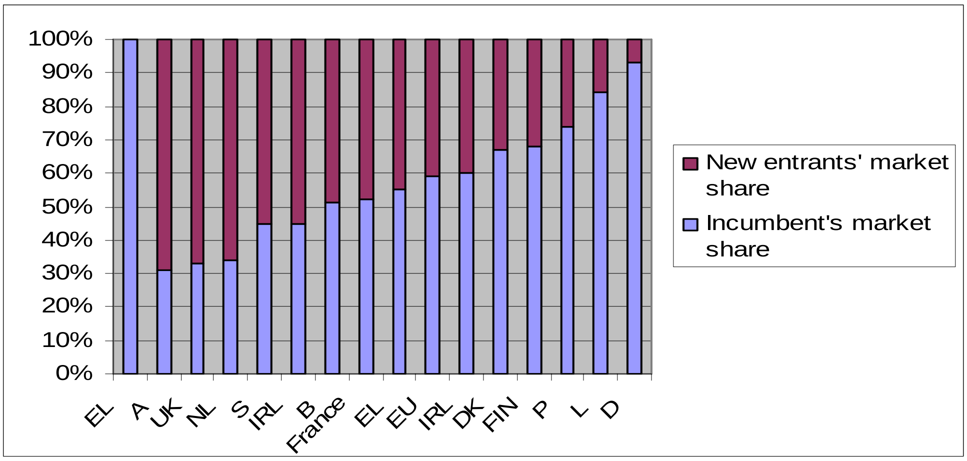

Fig. 2. Broadband market share in Europe, incumbents versus new entrants (source: Arcep, 2004 and 2005)

Today, nine national operators (each with comparable geographical coverage) compete in the French broadband market (Table 1), seven of which provide only DSL. The incumbent operator FT-Wanadoo leads (51.5%), ahead of same-technology competitors AOL France (7.5%), Alice (7.5%), Cegetel (4.5%), Club-Internet (4%), Neuf Telecom

[3] Besides cable and Wifi, alternative technologies also include satellite and FTTH (Fibre To The Home) which are not considered here, since they concern a very limited number of end-users.

(2%), and Tele 2 (2%). Free, at 16.5%, is the sole Wifi provider. There are also three cable companies providing broadband, with Noos being the only performing firm among these (4.5%).

Table 1 Key figures (in January 2005)

Technologies	Cable	DSL	Wifi
Number of subscribers: 3,436,800	154,656	2,474,496	567,072
Firms (market share %)	Noos (4.5)	FT (51.5) AOL France (7.5) Alice (7.5) Cegetel (4.5) Club Internet (4) Neuf Telecom (2) Tele2 (2)	Free (16.5)

It appears from these elements that FT, which is at the origins of the leading technology, dominates having attracted the largest share of subscribers.

In broadband Internet and in the computer industry overall, a large lead in price and speed by one firm over an incumbent should have attracted new customers and been sufficient to motivate a buyer to incur the cost of switching for the additional benefits (Greenstein, 1997: 257). But in our case, adoption mechanisms by end-users must be strongly characterised by inertia. This situation is puzzling given that most ISPs entered the marketplace with cheaper offers, as shown in Table 2. This table lists monthly prices offered by the nine main broadband ISPs. Apart from the package offered by Alice, we exclude those with unlimited access to phone calls. Once installed, technologies compete mainly on the basis of the speed available to consumers. While speeds range from 4 to 20 Mb, ISPs offer at most three levels, as seen in the Table. At present, apart from Tele2 and Noos providers offer the average download speed and all offer at least 16 Mb. This has two obvious implications. Firstly, consumers need not switch their current provider to reach higher download speeds. Secondly, switching may however cost the consumer. For example, DSL consumers must replace their modem.

Table 2. Supplier tariffs

Speed (Mo)	Wanadoo (FT) [(a)]	Free	AOL	Alice [(b)]	Noos	Cegetel	Club Internet	Tele 2	Neuf Telecom
1					24.90				
2								23.85	
4			34.90		29.90				
6		29.99				14.90		14.85	
6						24.90			
8	29.90		19.90	29.95			26.90		
16		29.99		29.95		14.90	19.90		14.90
18	37.40		19.90						
20		29.99			34.90				
(1)	12			12	12		12		
(2)		60.00	49.00		40.00	40.00		60.00	45.00
(3)	36.00		49.90			36.00	60.00	30.00	36.00
(4)	36.00	60.00	98.90	0.00	40.00	76.00	60.00	90.00	81.00

(1) Subscription period

(2) Cancellation fee, in €. Free charges €96 minus €3 multiplied by the number of months in order to cancel the contract. The Noos cancellation fee corresponds to cable disconnection.

(3) Cost of the Modem. Immediate purchase in the case of AOL. Cost of a 12-month rental for other firms.

(4) Sum of (1), (2) and (3)

[(a)] FT's 18 Mo offer costs €29.90 for the first three months, rising next to €39.90.

[(b)] Alice offers unlimited access to phone services. Access to TV channels is only included in the 16 Mo offer.

Cells (1) to (3) outline the existence of a subscription period or not. Firms also vary with respect to demanding a cancellation fee, its level and of the rental or one-off purchase cost of the modem. We note that firms substitute a subscription period for cancellation fees, the only exception being Noos which includes both.

To conclude this section, the competition in technologies predicted by regulation authorities in fact is not so great, with the penetration of new entrants' technologies being very low. Competition between firms, being another factor favoured by competition authorities, ended up under the domination of the incumbent, FT. The broadband industry is thus characterised by significant inertia phenomena, as analysed in the following section.

3 Causes of inertia

One could conclude that the causes of inertia in an industry like broadband essentially come from the supply side. The incumbent, FT which has operated in the sector for decades and necessarily enjoys a first-mover advantage, dominates the industry. However, one could also suppose that regulation may have produced at least a counter-balancing effect by stimulating the entry of high-performing new ISPs with the same technology at lower Internet subscription fees, or new entrants with radically new technologies. Any such counter-balancing effect proved to be rather ineffective indeed. In this section, we further underline the fact that inertia also has strong demand-side determinants, which is less evident in a sector where end-users can collect all the information necessary to compare prices, services and select the best provider with the most efficient technology. Finally, we argue that there is a link between technology and demand inertia. A low level of switching between providers may imply the dominance of a certain technology. A competitor that enters with an alternative technology knows that it may not attract the incumbent's customers easily as these would have to learn how to use this alternative technology. Such learning represents a kind of switching cost. In fact, the majority of new entrants in broadband Internet (six out of eight) entered using the incumbent's technology.

3.1 Inertia on the supply side: imitation of the incumbent, reluctance to introduce novel technologies, and distortion of competition

Inertia on the supply side may be the result of various elements. The literature on technology adoption provides a series of empirical results, including "leaders and laggards" issues. In the manufacturing industry, Klepper (2002) compares very competitive and oligopolistic markets to suggest that competition plays a strong role in the adoption of cost-reducing technology. In network industries, Dranove and Gandal (2003), and Gandal, Kende and Rob (2000) also document that competitors are not always incited to adopt quality-enhancing technologies and standards. In the narrowband industry, Augereau and Greenstein (2001, 2004) argue that ISPs were often reluctant to adopt 56K modems as more of their local competitors had done so.

The "first mover effect" described in industrial dynamics (Klepper, 1997; Agarwal and Gort, 1996; Green *et al*., 1995) can explain how, in an industry where the development of a new technology is based on previous investments in infrastructure and facilities, the incumbent may win in most cases. The first mover is able to enjoy economies of scale and scope, may benefit from existing market domination in related markets (fixed and mobile services), has greater financial facilities and better brand recognition. This kind of argument is also consistent with the literature on network externalities (Economides, 1996; Katz and Shapiro, 1986). The firm that has invested in essential facilities and occupies a dominant position in related markets (here, for instance, fixed and mobile telephony) may well maintain its leading position and survive fierce competition instigated by new entrants (Bernheim and Winston, 1985).

However, it is also conceivable that new entrants, offering cheaper products/services than the incumbent doted with the same technology, or offering higher quality services with a radically new technology, may gain important market share. There may be thus a "new entrant effect" that could counterbalance the "first mover effect", in this way limiting inertia phenomena, for the following reasons. New entrants arrive with new technologies that incumbents were not incited to develop, and their small size favours reactivity to market opportunities (Klepper, 1997; Geroski, 1994). This idea clearly motivated the implementation of regulation policies in broadband, and more widely in the telecoms industry (Laffont and Tirole, 2000). New entrants were deemed to out-perform incumbents (Fransman, 2002). The notions of timing of entry and cohort of entrant can provide some substance to the role of new entrants: even a late mover may challenge the incumbent, although very often in a small market niche (Klepper, 1997; Klepper and Simons, 2005).

The lessons to be drawn from the introduction of regulation policies in the French broadband industry proved quite a contrast, since the new entrants did not in the end out-perform the incumbent, and the incumbent is still largely dominant (as is its technology). Thus the “first mover effect” clearly occurred and prevailed over the “new entrant effect”.

Various elements can account for the prevalence of the inertia phenomenon which we observe in the French broadband industry. Imitators of the incumbent technology, such as AOL, Cegetel, T-online/Club Internet, Neuf Telecom and Tele 2, provide cheaper services (see Table 2) using the same technology, but appear as minor players. In this case, imitation may not be the key to success in a situation where the incumbent has established brand recognition. Despite its efficiency, reliability and user-friendly characteristics, Wifi is underdeveloped. Free is the only provider of this kind of technology, and still occupies a relatively small portion of the market. New entrants thus appear to be reluctant to develop new advanced technologies (Wifi, but also satellite and FTTH), which is relatively surprising in a market which is not yet mature. Cable started quickly but is stagnating today. In fact, the incumbent operator has large shareholdings in competitors Noos, NC Numéricable, and UPC France, owning directly or indirectly 40% of the capital of cable operators. This reveals that this particular type of competition distortion induced very low incentives to develop the cable technology in France, a distortion that does not exist in most European countries where end-users rely more widely on cable (Krafft, 2006b).

Though existing frameworks in industrial dynamics can account for the dominance of the large, incumbent firm, there are still unresolved issues, for example: why imitators (DSL-based competitors) occupy only market niches even though their services are cheaper? Why are innovators (Wifi-based competitors) so few and not performing better? We argue that there are strong inertia factors on the demand side that have to be explored.

3.2 Inertia on the demand side: a role for switching costs

Though broadband ISPs entered the marketplace by offering an Internet access technology of their choosing (modem, connection equipment), the consumer's fundamental objective when selecting a provider is to access the Internet cheaply, regardless of the technology that accompanies this offer. Therefore by not switching to an unknown albeit cheaper entrant, it could be said that consumers voluntarily choose not to switch to a potentially more efficient technology. Accordingly, the high cost of switching brands would not only be a cause of consumer inertia but also of technological inertia.

Unlike most of the literature, the assumption that end-users seek compatibility between technologies is irrelevant here.[4] Services available to broadband Internet consumers do not vary according to the technology. Thus it is not expected that the user's value from using a certain technology increases with the number of adopters of that technology. Put another way, technologies are neutral vis-à-vis Internet services available to customers and they are not used by providers as a means of segmenting end-users with respect to Internet practices. Nonetheless Wifi customers have some benefit in that the technology allows a more flexible utilisation but without affecting the range of services available to these customers.[5] Thus, despite the publication of a huge amount of information concerning the different network connection technologies available, it is not certain that all consumers know how to rank these technologies. We can assume that, prior to use, most DSL and Wifi consumers are indifferent about the choice of technology to adopt, since they are generally incapable of ranking them according to the service quality these technologies will provide. Consumers would be more responsive to the range of speeds available from their provider, which could clearly be an element of vertical differentiation, though this hypothesis is not really explored in the present paper.

[4] For example, Greenstein's (1997) critical point is that switching costs in the mainframe computer vending market arise due to incompatibility between operating systems or hardware.

[5] Conversely, mobile phone providers can discriminate between consumers on the basis of the sophistication of the mobile, that is, whether it includes a camera, enables access to the Internet, and so on.

In a model with decreasing average costs and a sufficiently large switching cost, Beggs (1989) provides a theoretical foundation for this observation. Switching costs and decreasing average costs together generate an indirect network externality in that the greater the number of consumers who buy a firm's product, the more likely it is to survive and the more attractive it is to other customers, regardless of whether this product performs better. This firm's price would inevitably be low if it wanted to serve all customers. Thus, any consumer could expect a low price should he or she select that firm, provided that all other consumers select that firm too. This theoretical result is relevant to our research as the condition that consumers' preferences exhibit direct network externalities (Katz and Shapiro, 1986) is not necessary for Beggs's result to hold.[6]

Schematically, the utility of each customer of Internet supplier *a*, using technology 1 (for example Cable), does not need to increase with an increase in the total number of consumers adopting technology 1. The Beggs (1989) model suggests that it is likely to increase with an increase in the number of consumers subscribing to *a*. In the author's words (p. 437): "…the more consumers who buy a product the more likely it is to survive and the more attractive it is to other consumers." It is nonetheless important that all consumers have sufficiently large switching costs to rule out the possibility of subscribing to another provider in a later period.

The Beggs model is however not very suitable for measuring switching costs. It contains a large number of parameters on firms' costs and consumers' willingness to pay. Beyond this, consumers only differ with respect to their valuation of the product/service they purchase. They are not attached differently to the different brands. The model thus does not capture two essential features of the broadband industry, which we believe are brand differentiation and the perceived cost of learning how to use the different (albeit substitutable) technologies. Firms did not enter the market simultaneously and there is a long-established incumbent competing with new and

[6] There are several reasons why consumers may prefer a technology having more ISPs servicing it. The most relevant here (see Greenstein, 1997: 9) is basically that more providers using a standard lowers the consumer switching cost as well as ensuring that they will not be technologically stranded if their provider shuts down.

aggressive entrants. In Shy's model (2002b), which we shall use to calculate switching costs in France, firms are differentiated with respect to switching costs.

In doing this, we complete the supply-side analysis of the reasons for this inertia, measuring customer switching costs as between ISPs offering broadband. We employ Shy's measure for estimating the per-customer switching cost which requires only data on prices and market share (Shy, 2002b).

4 Details on switching costs in broadband Internet

Considering that ISPs provide 'homogenous' access to the Internet, consumers will select a particular provider mainly on the basis of the prices it offers, its reputation and to what extent they perceive a large cost of switching to an alternative provider with a potentially different technology. Let us consider what types of costs a typical switcher faces in residential broadband markets.

They are essentially cognitive costs, plus the eventual cost of switching to an alternative technology. The former seems important and is essentially a result of brand reputation and experience with one's current supplier. If a consumer is initially indifferent as between the services of two competing providers, the fact of using a brand will change the consumer's relative utilities for the products, meaning that they will perceive a cost in switching brands. This is a result of people's desire to reduce cognitive dissonance (see Klemperer, 1995: 518).[7] Reputation may play a major role in the broadband industry where firms are ranked according to the quality of service they provide to customers. The different existing technologies require specific investments in terms of how to use them, because they involve different technical difficulties. Such specific learning costs are a component of the overall switching cost. A consequence is that once a large base of customers invests in one provider's technology, that provider has no

[7] Following Klemperer's argument, most broadband Internet customers prefer their current supplier's service because they are used to it, and have learned to like the benefits it provides (purchasing goods through Internet, chatting, and so on).

incentive to design one or more of the alternative technologies already supplied by competitors.

Transaction costs in closing an account with one's current provider and opening another with a competitor are systematic and may imply changing e-mail addresses. This could be measured in terms of the value of lost time involved. In some cases, consumers have to pay cancellation fees that may be relatively high (up to €96 with some providers). Consumers must also find out which ISPs operate in their local area, and which offers the best package for their needs.

However, this specific transaction cost based on comparison and selection of providers is significantly lower in the broadband industry (compared to other industries), since free ranking services are available on the web. Contractual (or artificial) costs are also present in that customers often have to respect a subscription period, generally 12 months. The existence of this cost means that the value consumers place on their time has to be high (Shy, 2002b).

Switchers not only have to pay the cost of switching brand but possibly that of changing to a different modem or a radically different technology to access the Internet. Both costs need to be very large. Shy (2002b) found high values in the mobile phone industry. We are not in a position to calculate these separately without more documented data on consumer behaviour. We shall attempt to calculate the sum of the cognitive cost and the cost of switching to an alternative technology using a quick albeit approximate measure.

5 A measure for switching costs in broadband Internet

We consider that the main competitors in broadband are those with a market share of greater than 1%. These ISPs, their tariffs and relative market share are set out in Table 3. We ranked firms according to market share, from highest to lowest. Across firms, prices and market share are positively related (see also Fig. 3). FT records the highest average price and also the highest market share while the second largest firm charges the second highest price. The magnitude of the correlation coefficient between annual fees and market share is 0.67.

Table 3. Internet offers

Technology [a]	Provider	Market share (%)	Annual fee
	FT	51.50	439.80
Wifi	Free	16.50	419.88
	AOL	7.50	397.70
	Alice	7.50	359.40
Cable	Noos	4.50	398.80
	Cegetel	4.50	294.80
	Club	4.00	340.80
	Tele 2	2.00	322.20
	Neuf	2.00	259.80

[a]. No entry indicates a firm that provides DSL

We calculated annual fees on the basis of lump-sum fees proposed in January 2005, as shown in Table 2. We were able to consider the nine providers set out in the Table by taking the average price across the different speeds offered. It would have certainly been more accurate to consider a single download speed but this would have meant excluding several suppliers from the analysis. The speed that corresponds to the highest number of providers, five exactly, is 16 Mo. However, FT does not have a 16 Mo offer and we wanted to include the incumbent in our analysis.[8]

We arbitrarily consider the case of customers who receive a modem from their selected provider and remain a customer for one year. This has some implications for computed tariffs; for some providers, the customer must pay cancellation fees at the end of a 12-month subscription period, and these have been included in our analysis. Taking into consideration customers of more than one year would (inconveniently) necessitate

[8] We do not weight prices when calculating the annual fee, which implicitly assumes that consumers are distributed uniformly across the different speeds offered by each firm.

having to account for changes in tariffs (some firms change their tariffs after a 12-month subscription) and make assumptions on how consumers discount the future.

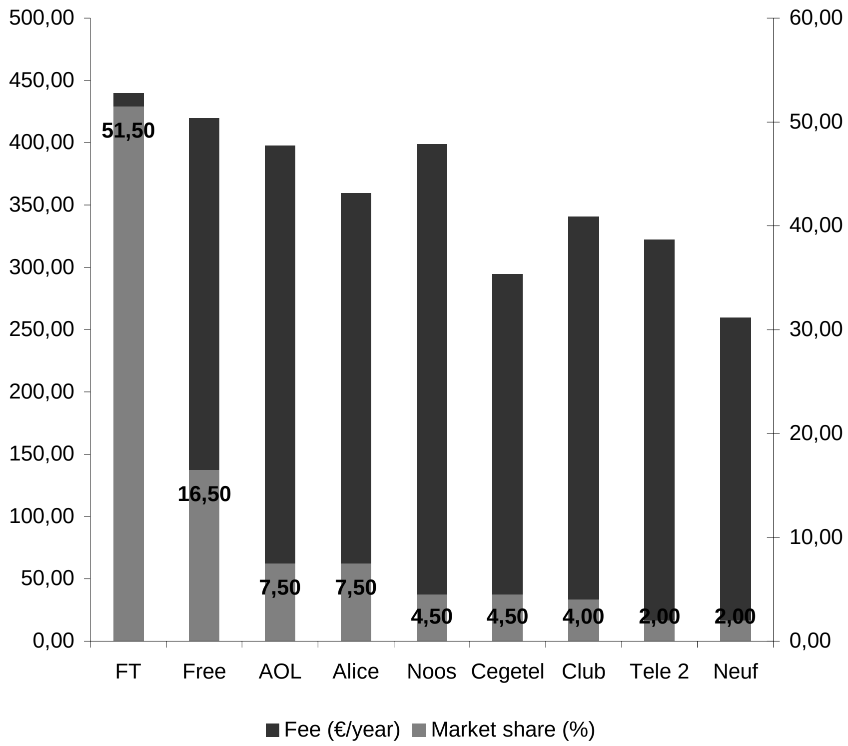

Fig. 3. Prices and providers' market share

Our calculation of switching costs uses Shy's measures (2002b). The model assumes that firms set prices. Each firm considers whether to undercut one and only one competing firm at a time. The generic model is thus restricted to the description of competition between two firms. Two firms *a* and *b* sell an homogenous service to *N* consumers. There are $N_\alpha > 0$ brand *a*-oriented consumers (type α) and $N_\beta > 0$ brand *b*-oriented consumers (type β), with $N \equiv N_\alpha + N_\beta$. Type α consumers incur a cost s_{ab} of switching to firm *b* while type β incur a cost s_{ba} of switching to *a*. The model solution (see Shy, 2002b) leads to the following measure of switching costs for type α $s_{ab} = T_a - N_\beta T_b / N$ and the following for type β customers $s_{ba} = T_b - N_\alpha T_a / N$, where T_a is firm *a*'s price and T_b is that of firm *b*.

The model allows for negative switching costs. A negative value for say s_{ba} can be interpreted as a willingness to switch from b to a but price differential (the monetary gain from switching) is actually too low to induce switching. Consequently, we prefer to interpret switching costs as net values, a concept introduced by Green (2000) in the electricity market.

We calculated switching costs between FT and four entrants, namely Free, AOL, Noos and Neuf Telecom. We selected Free and Noos as they offer alternative technologies to DSL. AOL was chosen on because it is the oldest firm competing with FT in the French broadband market. Neuf Telecom is the smallest entrant in the DSL market thus we expect its customers have small switching costs. Our results for the measurement of switching costs appear in Table 4.

Table 4. Switching costs (€) in the French broadband retail market

		Target firm				
		FT	Free	AOL	Noos	Neuf
DSL	FT		337.92	389.24	407.75	430.09
Wifi	Free	86.80		295.60	334.42	391.79
	AOL	13.81	109.03		248.15	343.01
Cable	Noos	–5.66	68.89	150.24		318.86
	Neuf	–163.56	–114.69	–54.17	–16.29	

The outcomes of our calculation of customer switching costs reach high values, including up to the level of annual fees. For example, the highest switching cost calculated is €430.09, which is only slightly below FT's average price (€439.80). This means that a typical FT customer who wishes to switch to Neuf Telecom stands to save €180 but would incur switching costs of €430.09 (see Table 3). There are however new customers subscribing every year, for whom switching costs must be high since they have not learnt how to use the product.

It should be remembered that one must interpret these costs as net switching costs; the difference between the gross cost of switching an added-value (the positive extra utility that customers attach to the target firm). The gross cost of switching includes transaction, contractual and some cognitive costs (see section 4). The value given to the likelihood that the origin (target) firm will survive is assumed to enter the cognitive part (added-value) of gross (net) switching costs.

The broadband Internet industry exhibits the key characteristics of an industry with customer switching costs. Interestingly, the largest and second-largest firms are also those which charge the highest prices on average and whose customers generally have higher switching costs. Switching cost theory provides a nice explanation for that. New entrants tend to undercut larger firms already present in the market in order to grab not only these firms' customers but also new customers. Once won, customers develop brand loyalty even where entrant firms are concerned, meaning that these firms can later maintain or charge higher-than-average prices. Besides this, the presence of switching costs explains price competition when new groups of customers enter and can be charged separately from others. As an illustration, Cegetel increases the price of its 6 Mb package after a 12-month subscription. The 18 Mo offer from FT is priced at €29.90 the first three months then rising to €39.90.[9] This practice is referred to in the literature as 'bargains-then-ripoffs' pricing, where firms can increase their prices once customers are locked-in.

FT's market share has decreased since market deregulation while new entrants Neuf, Cegetel, Club, AOL, Alice and Tele2 won 129,000 customers during the third quarter of 2005 alone. It is certain that these firms' customers switch mainly on the basis of price rather than technology, as these firms and the incumbent all use DSL. FT also wins new customers, attracting 335,000 during the same period. We believe these new customers almost certainly attach a high value to the firm, whose reputation has not deteriorated. Given its market share, potential new customers may well perceive FT as being the firm most likely to survive.

Between FT and Free, customers' switching costs must be of a different nature since these firms did not supply the same technology over the period studied. Our result shows that the cost of switching from Free is quite high while that of switching from

[9] This price excludes the cost of the modem.

AOL, Noos and Neuf to Free is comparatively small. There may be several reasons why Free's customers are significantly locked-in. First, Wifi technology may create a particular degree of attachment to Free. Besides this, we also believe that customers who chose Free made their choice on the basis of its high-speed offers. Free won 130,000 new consumers during the third quarter of 2005 by supplying not only an alternative technology, but also cheaper and higher speed offers than the established firm.

The negative costs of switching support the observation that the incumbent is likely to win back lost customers. Neuf's customers bear a cost of switching to FT of about –€163, which is interpreted as a disutility of staying with Neuf. But we note that this disutility is insufficient to induce current Neuf customers to make the switch to FT. FT's annual fee (switching cost inclusive) €439.80 – €163.56 = €276.24 remains larger than the price charged by Neuf, 259.80. It seems very likely that Neuf and also Tele2 (each having equal market share) will leave the market through failing to lock their new customers in. To respond to this market pressure Neuf and Cegetel merged in August 2005. The group's market share attained 6.5%, thus positioning it in fourth place.

6 Conclusion

Broadband Internet can be provided by different technologies, one of which – DSL – widely dominates this market and is supplied by the large incumbent, FT. This paper has shown on empirical grounds that this situation of technological inertia can be explained by customer switching costs and by other supply-side factors. Switching costs act as a barrier to customer mobility thus bringing about a dominance of the technology supplied by the largest firm, in this case, FT.

Overall large (respectively small) broadband providers tend to serve customers with high (respectively small or negative) net switching costs. Wifi technology could entail a particular lock-in. Historical factors play a major role here as the firm providing it, Free, entered the broadband market not only with cheap prices but more importantly, it supplied higher-than-average connection speeds. We believe that Wifi technology may have been confused with high speed. The range of speeds provided by a firm warrants future research as an element of vertical differentiation common to all firms while they would be – horizontally – differentiated with respect to switching costs. This assumption remains speculative in the French context as no household survey is available regarding customers' choice of broadband ISPs.

Some firms' customers seem very likely to switch back to the incumbent but find this transaction too costly. This raises policy concerns as it suggests not only that the number of firms competing with FT is likely to decrease but also that future entrants will have difficulty grabbing new customers. Price differential is insufficient to induce switching but also too high to make entry profitable. Any action to reduce switching should be taken by the relevant institutions, provided the benefit to society can be expected to outweigh its costs (including the cost of taking such action). An accurate measure of switching costs is thus considered necessary.

The European directives on broadband communications markets implemented in France in line with the Lisbon strategy have not yet produced the targeted outcome of fostering and consolidating competition. Rather, high switching costs have seemed until now to impede such competition by widening the gap between large leading companies (FT and Free) and smaller laggard competitors, by generating an inevitable consolidation movement among small competitors, and by preventing profitable entry. Under these conditions, the objective of increasing competition in the future is also questionable, since FT's recent strategy is to develop Wifi as well. This Wifi development strategy, together with attractive price differentials, that is, sufficient to induce customers to switch, may eventually alter Free's position if its customers are primarily attached to the Wifi technology. Future possibilities, especially in terms of regulation, would thus be whether the development of a knowledge-intensive, fast growing and non-mature industry can still be enhanced by only one dominant company, namely FT.

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