Mobile-only consumers arise from heterogeneous valuation of fixed services

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November 2016

Abstract

Mobile-only users are usually considered as a consequence of fixed-mobile substitution. This study uses a unique dataset based on a large European country survey and consumer invoice data to reveal heterogeneous consumer preferences for fixed services. The data is fitted in a mixed logit model and willingness to pay (WTP) for fixed communications services is estimated. Results show that mobile-only consumers have a WTP of €15 per month for fixed services, while the WTP of consumers who use both fixed and mobile services is three times higher. Given that the typical monthly cost of fixed services is around €30, heterogeneous preferences for fixed services constitute an alternative explanation for the existence of mobile-only users, despite the complementary nature of fixed and mobile broadband.

Key Words: *fixed mobile dependence, heterogeneous preferences, substitution versus complementarity, mobile only*

JEL Classification: L43,L50, L96

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1 Introduction

Fixed-mobile substitution on voice services is well documented. However, the relationship between fixed and mobile broadband remains unclear and appears to be different. Many consumers use both types of connection. At home, fixed broadband service is generally strongly preferred because it offers higher connection speeds and virtually unlimited data volumes. By definition, however, consumers cannot used fixed services outside the range of their WiFi connection [1]. This seems to indicate an intuitive complementarity between fixed and mobile broadband services. There is still little relevant literature on the relationship between fixed and mobile broadband. The first aim of this paper is therefore to assess this complementarity.

Mobile-only consumers are more common in the US than in France. Close to 40 % of US consumers are mobile-only, four times the percentage of mobile-only users in France. The explanation provided in this paper is based on the heterogeneity of consumer preference for fixed services. An estimation of French consumers' willingness to pay (WTP) for fixed communication services reveals that consumers who subscribe to both fixed and mobile services have a much higher WTP than their mobile-only counterparts. Thus, given that fixed services are much more expensive in the US than in France, mobile-only consumers are more common in the US.

The French communication services market has shown impressive dynamics in terms of prices, mostly driven by competition on the market. For instance, some quadruple play offers, launched in 2009, provided consumers with a strong incentive to combine their fixed and mobile offers since the quadruple offer is cheaper than the sum of the stand-alone service prices. The other market players naturally followed this trend in order to reduce churn. The French market has a significant level of quadruple play penetration, 24% in 2015, putting it second in Europe after Belgium (27%).

Despite highly competitive pricing, market dynamics are also driven by technological evolutions. The adoption of IP technology on the fixed and mobile core network, as well as the

[1] WiFi Hotspots are, of course, deployed in many public places. However, they do not offer the same ubiquitous coverage as mobile networks.

deployment of optical fiber for mobile base stations' traffic backhaul, led to the replacement of traditional voice networks with data networks. This technological transformation, which occurred on the fixed network in the early 2000s, allows operators to provide voice over IP (VoIP) as a basic, generic component of triple play offers. On the mobile market, voice and SMS services account for a declining share of the cost of mobile plans, which is increasingly dominated by mobile data. However, the scarcity of mobile network resources means that carriers cannot offer unlimited data volumes for mobile plans, unlike for fixed broadband technology. Fixed broadband services thus provide added value compared to mobile services in terms of data volumes, which may explain the large percentage of consumers who use both networks.

Market evolutions are thus influenced by the demand side as well as the supply side. For service providers, it is therefore crucial to understand not only the changes occurring in the market but also their underlying dynamics. While supply side influence is mostly a question of investment capacities and marketing efforts, the present paper focuses on the demand side.

Consumption behaviors constitute the central point of this study, which introduces a micro-econometric model. Survey data on French interviewees combined with their detailed billing data is fitted in a conditional mixed logit model. Individuals have three alternative consumption choices: i) using only a mobile offer; ii) purchasing a stand-alone fixed offer in addition to their mobile offer; or iii) subscribing to a quadruple play offer.

The remainder of the article is organized as follows. Section 2 discusses the relevant literature. Section 3 presents the data used in the estimation. Section 4 introduces empirical model. Section 5 presents the main results. Finally, Section 6 concludes the paper..

2 Literature Review

The relevant literature be reviewed here focuses on the characteristics of demand for telecommunications services. Early academic literature on this issue, published in the 1970s, mainly focused on estimating demand elasticity with respect to prices, in an era marked by high inflation and upward pressure on call rates (Taylor, 2002). Later, with the increasing popularity of

mobile services and thus the emerging replacement of fixed services with mobile services, the literature integrated non-price factors, such as socio-demographic factors, to profile consumers based on the services they use.

Rodini, Ward and Woroch (2003) used a logit model to estimate cross-price elasticities between fixed and mobile voice services. Their study was based on microlevel data from 2000-2001 in the US. In addition to the significant impacts of usage, access and prices, the authors found that socio-demographic variables such as income, education and household size have a positive impact on the probability of taking out a mobile subscription, to the detriment of a second fixed line subscription. In contrast, the older the person surveyed, the lower their probability of subscribing to a mobile voice service.

Similarly, Ward and Woroch (2004) analyzed substitution patterns in the US in 1999-2001 and concluded that non-price factors like mobile network coverage and quality also play a major role in mobile subscription take-off. Using data from 2004 to 2006, Schejter et al. (2010) performed separate cluster analysis on the wireline and wireless market segments in order to identify the characteristics of the consumers in each segment. Their results revealed that wireless users are predominantly young and low-income. Moreover, home owners are more likely to be fixed line users. The authors also concluded that mobile-only consumers are newcomers to the markets, reflecting the emergence of a new type of consumer rather than a shift among existing consumers. Macher et al. (2010) empirically estimated a consumer choice model using household-level observations from 2003-2010 and found that fixed and mobile voice line subscriptions are replacements, rather than complements. Grzybowski & Verboven (2014) found significant fixed-mobile voice substitution with substantial heterogeneity across households and EU regions. Their paper also revealed that the decline in fixed telephone lines has slowed due to the high degree of complementarity between the fixed-line and mobile connections offered by the fixed-line incumbent operator.

With the emergence of broadband Internet access, several studies focused on estimating the demand for the different Internet access technologies and deriving consumers' willingness to

pay for different components of the available offers. For instance, Savage and Waldman (2005) provided evidence that high income households and individuals with higher education are more likely to subscribe to a high-speed broadband connection. They also showed that consumers' online experiences are another influential factor.

Rosston, Savage and Waldman (2010) designed a discrete choice experiment to show consumers' willingness to pay for Internet service improvements like increased Internet connection speeds. Their results revealed that US citizens are willing to pay $3 more in order to enjoy very fast Internet rather than fast Internet. This is an interesting result, as it raises the question of whether or not deploying a nationwide optical fiber network is economically justifiable.

Estimates of broadband access demand in Europe also identified variables that influence the consumer decision making process, including income, education and household size. For instance, Srinuan, Srinuan and Bohlin (2012) illustrated these findings for Sweden using data in 2009 and Cardona et al. (2009) analyzed the Austrian market with 2006 data. The former showed that in Sweden low-income people have a higher probability of using mobile broadband instead of fixed broadband (fiber or DSL), while the same probability is lower in rural areas. A similar result is found for the Austrian market: Vienna residents are more likely to subscribe to a mobile broadband offer. Level of education, however, seems to play a less important role in Sweden than in Austria.

The relevant literature also includes reports issued by government agencies like the various national regulatory authorities, consulting agencies and national research centers. For instance, a report issued by DotEcon (2001) studied fixed-mobile substitution in 2001 and drew consumer profiles for mobile-only consumers, fixed-only consumers, and fixed and mobile consumers in the UK. Similar studies were produced in France by CREDOC (2014) and at the European level as part of the Eurobarometer surveys.

Both studies provided essentially the same insights: single-service usage is favored by low income (for mobile-only usage) or higher age (for fixed-only usage). However, these studies mostly provide inventories and descriptive statistics on these phenomena rather than econometric

analysis.

The major contribution of this paper is the usage of an original dataset of more than 1,000 consumers during the period spanning January to December 2012. The results are different from those described in the existing literature. There are two reasons driving mobile-only consumers: higher price sensitivity and lower valuation of fixed services. Each consumer has to decide either to buy two complementary goods or to select only one of them. However, one of them is less valued and some consumers exhibit high price sensitivity. Therefore, consumers who are not willing to pay the fixed component monthly fee in addition to the mobile fee, especially low-income individuals, prefer to become mobile-only users.

3 The Data

The data, provided by the GFK Institute for surveys, covers the period from January to December 2012. During this period, 1,069 consumers were contacted on their mobile phone and asked to indicate which means of electronic communications they use for their personal needs. The present study uses these indications to determine whether a given consumer is mobile-only. In particular, respondents are considered as mobile-only if they use only a mobile plan to meet their consumption needs.

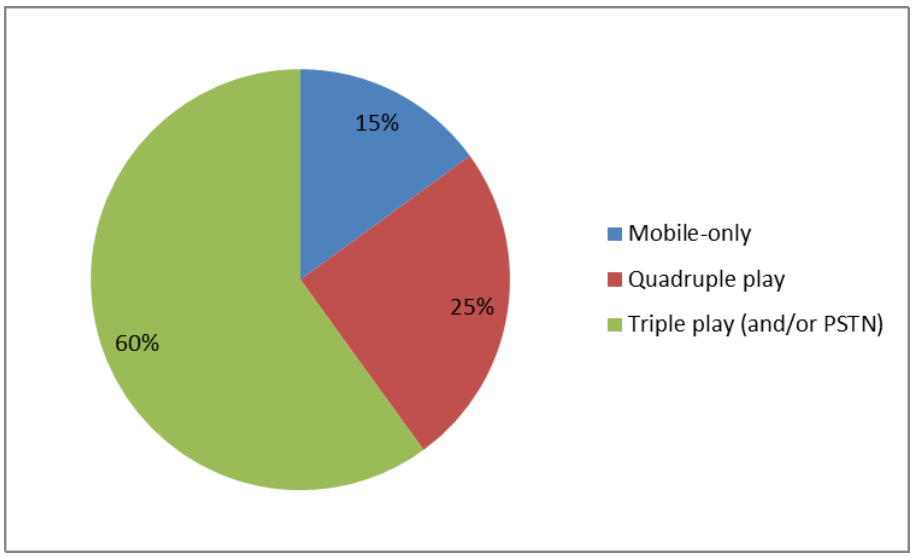

Figure 1: The distribution of consumption type in december 2012

The pie chart in Figure 1 shows the distribution of the 1,069 respondents among the three types of consumers in December 2012: mobile-only (15%), fixed-mobile with separate fixed and mobile service subscriptions (60%) and quadruple play (25%). Respondents who have separate fixed and mobile service subscriptions can be divided into two groups: i) fixed-mobile users who have PSTN services without broadband access and ii) fixed-mobile users who have (in most cases) a triple-play offer and a stand-alone mobile offer.

The GFK survey collected data on certain consumer characteristics, including age, gender, number of children living at home, occupational status, and municipality of residence. For each municipality, the French national statistics office (INSEE) publishes the population density and median household revenue.

We also collected two others datasets for the GFK survey respondents. These datasets includes information about the respondents' monthly bills, characteristics of their mobile and/or quadruple play offer and the type of handset used during the period in question.

Unfortunately, not all of the respondents provided information about their monthly fixed service bills. However, the monthly fees for mobile services and quadruple play offers were

exactly observed in the dataset. For consumers with a mobile offer combined with a separate fixed offer, a monthly fee of €30 was added [2], reflecting the most popular triple-play price observed on the French market.

Based on the descriptive statistics, mobile-only consumers are more common among low-income households, jobless and/or young people, and people without children.

As in all choice models, consumers must be confronted with a set of possible choices. This study's choice set was built similarly to Grzybowski & Liang (2015). For each month from January to December 2012, consumers had the option to choose one of the following options:

(i) keep the same offer as in the previous month; (ii) switch to a new mobile offer from the list of offers available that month; (iii) switch to a new mobile offer and combine it with a stand-alone fixed offer [3](iv) switch to a new quadruple play offer; (v) for fixed-mobile consumers, leave for another mobile operator but keep the same fixed service (option not available for mobile-only respondents).

4 Empirical model and identification strategy

A discrete choice model was used in this study. In this type of model, a decision maker faces a finite set of mutually exclusive alternatives, from which he or she chooses one and only one. There were up to 69 different alternatives available to consumers each month in the time period considered.

Certain types of discrete choice models can be based on a logistic distribution of choice probabilities. These models can be divided into multinomial logit models, where the exogenous variables vary with the individuals (e.g. age, occupational status, etc.), and conditional logit

[2]There are four types of consumers in our dataset. (1) Mobile-only consumers, whose monthly fees were exactly observed. (2) Quadruple play consumers, whose monthly fees were also exactly observed. (3) Fixed-mobile consumers with a PSTN subscription without broadband access. (4) Fixed-mobile consumers with fixed broadband access (mainly a triple play offer). The monthly fee of €30 for a triple play offer is observed on the French fixed broadband market. It is assumed that the Cases (3) and (4) have a monthly fee of 30 euros.

[3]same mobile offer list than in (ii)

models, where the exogenous variables vary with the alternatives in the choice set. Prices are the archetypal variable in a conditional discrete choice model, but the data allowance in mobile subscriptions (which may differ between offers) is another example.

Multinomial and conditional models can also be combined. In this case, the set of exogenous variables contains both alternative-specific and individual-specific variables. However, these models should not be confounded with a mixed logit model, which can take into account the heterogeneity of individuals. The study uses both alternative-specific and individual-specific variables. In order to be able to estimate this type of model, the individual-specific variables must be coded as alternative- specific variables, i.e. inducing variability for variables like Smartphone (indicating that the individual owns a smartphone).

We use a standard linear utility specification for individuals $i = 1, ..., N$ over the different offers $j = 1, ..., J$. Utility depends on offer characteristics and on the observable and unobservable individual characteristics. The utility of individual i for offer j in month t be given by:

$$U_{ijt} = V^f_{ijt} + V^m_{ijt} + \gamma_{fm} FMint + s'_{ijkt}\gamma_i + \epsilon_{ijt} \quad (1)$$

$$= x'_{jt}\beta^m_i + \delta_f \beta^f_i - \alpha_i(p^m_{jt} + p^f_{jt}) + \gamma_{fm} FMint + s'_{ijkt}\gamma_i + \epsilon_{ijt} \quad (2)$$

The observed utility of a mobile offer is $V^m_{ijt} = x'_{jt}\beta^m_i - \alpha_i p^m_{jt}$ and of a fixed offer and its interaction with mobile services is $V^f_{ijt} + \gamma_{fm} FMint = \delta_f \beta^f_i + \gamma_{fm} FMint - \alpha_i p^f_{jt}$, where the price of mobile offer and fixed component are respectively denoted by p^m_{jt}, p^f_{jt}, [4]and α_i is the individual-specific valuation of price. δ_f is the indicator for alternatives including a fixed component. Note that each consumer faces the same list prices of offers which are independent on consumption. All mobile offers include a mobile voice and data allowance. The individual-specific valuations of mobile offer attributes are denoted by β^m_i and the vector x'_{jt} includes the following variables: (i) a dummy for handset subsidy; (ii) a dummy for unlimited mobile voice allowance; (vi) mobile data allowance; (vii) mobile voice minutes included in the offer in case the mobile voice allowance is not unlimited.

[4]For quadruple play offer, the list price, is precisely collected in dataset, is the sum of mobile offer price and triple play price decreased by a bundle discount.

We thus included interaction terms for a dummy for fixed component with a dummy for unlimited mobile voice allowance, as well as with variables for mobile data and mobile voice minutes included in the offer. The aim of these interactions is to estimate potential substitution or complementarity between usage of mobile data and voice and fixed components.

The vector of switching dummies is denoted by s'_{ijkt}, as in Grzybowski & Liang (2015), and the coefficients γ_i represents disutility from switching which approximates switching costs. We consider two types of switching dummies. The first one , "switching", takes value of zero if consumer i in the previous month $t-1$ used alternative $k=j$ and one otherwise when $k \neq j$. The second one, "leaving", takes value zero for the choice of any tariff and one for the choice of outside option, which is to leave the mobile offer.

Finally, ϵ_{ijt} is a non observed utility component of alternative j for individual i at time t.

The vector of coefficients $\theta_i = (\alpha_i, \beta_i^m, \beta_i^f, \gamma_{fm}, \gamma_i)'$ depends on unobserved consumers' heterogeneity, i.e. $\theta_i = (\alpha_i, \beta_i^m, \beta_i^f, \gamma_{fm}, \gamma_i)' + \nu_i \sim N(0, \Sigma)$, where $(\alpha_i, \beta_i^m, \beta_i^f, \gamma_{fm}, \gamma_i)$ refers to a vector of mean valuations, ν_i is a randomly drawn vector from joint normal distribution with Σ represents a diagonal matrix with the diagonal elements being standard deviations around the mean valuations.

4.1 Choice Probabilities

An individual i chooses a tariff j in month t if this tariff maximizes the utility among all available alternatives, i.e., if $U_{ijt} = \max_{n \in C_{it}} U_{int}$, where C_i is individual i's available choice set. Hence, the probability that individual i with given random coefficients β, α and γ makes a sequence of tariff choices $j = \{j_1, j_2, ..., j_T\}$ is given by:

$$\begin{aligned} l_{ij}(\theta_i) &= \prod_{t=1}^{T} \Pr\left(U_{ij_t t} = \max_{n \in C_{it}} U_{int}\right) \\ &= \prod_{t=1}^{T} \frac{\exp\left(x'_{j_t t}\beta_i^m + \delta_f \beta_i^f - \alpha_i(p_{j_t t}^m + p_{j_t t}^f) + \gamma_{fm} FMint + s'_{ij_t kt}\gamma_i\right)}{\sum_{n \in C_{it}} \exp\left(x'_{j_t t}\beta_i^m + \delta_f \beta_i^f - \alpha_i(p_{j_t t}^m + p_{j_t t}^f) + \gamma_{fm} FMint + s'_{ij_t kt}\gamma_i\right)} \end{aligned}$$

where the second line follows from the distributional assumptions of the unobserved utility term ϵ_{ijt}.

A mixed logit model allows for unobserved consumer heterogeneity and requires integration of the conditional choice probability $l_{ij}(\theta_i)$ over the joint distribution of θ_i:

$$P_{ij}(\theta, \Sigma) = \int_{\theta_i} l_{ij}(\theta_i) f(\theta_i) d\theta_i. \tag{3}$$

where θ and Σ are the parameters to be estimated. This is mixed logit or random coefficients logit choice probability.

4.2 Identification strategy

Interaction variables are used to study fixed-mobile dependence for fixed services. In particular, we focus on the interaction terms involving the dummy for fixed components included in fixed-mobile combined offers [5].

The interaction between fixed and mobile only makes sense if a consumer owns a smartphone which enables the use of mobile data services. However, smartphone ownership is endogenous due to its correlation with unobserved characteristics of each individual that can influence their decision. To deal with this endogeneity, the dummy variable smartphone is instrumented with the density of the respondent's residential municipality. A control variable is included in both conditional logit and mixed logit regressions using a control function approach (Petrin and Train 2010). To introduce variability into the choice sets, the dummy variable smartphone is interacted with the handset subsidy option associated with each alternative.

5 Main results

The main results are based on a mixed logit specification whose parameters θ and Σ are estimated and reported in table 1 below. The variables included are: (i) characteristics of the mobile offer in each alternative, namely the list price, handset subsidy option, dummies for 12- and 24-month

[5] A fixed services component combined to a mobile offer by consumer is a stand alone offer. A fixed component combined to a mobile offer by operator is a quadruple play.

contract length, dummy for unlimited mobile voice allowance, number of mobile voice minutes when the voice allowance is not unlimited, mobile data allowance in GB, (ii) dummy variable for fixed broadband triple play, (iii) dummy for leaving which corresponds to an outside option, and (iv) dummy for switching which represents the situation when a consumer switches from an old offer to a new one.

VARIABLES	Mean	SD
price	-0.074***	0.016***
	(0.005)	(0.004)
terminalsubsidy	1.511***	0.462
	(0.215)	(0.406)
TriplePlay	7.827***	-5.184***
	(1.097)	(0.969)
unlimited	1.866***	-0.034
	(0.285)	(0.208)
voice	0.006***	0.004***
	(0.001)	(0.001)
datamobile	0.079	0.136*
	(0.089)	(0.078)
switching	-6.545***	-0.219
	(0.071)	(0.144)
leaving	-8.097***	-0.294
	(0.370)	(0.812)
TriplePlay_unlimited	-0.100	0.090
	(0.249)	(0.224)
TriplePlay_datamob_smartphone	0.625***	-0.010
	(0.088)	(0.084)
control_function	0.881***	0.468
	(0.208)	(0.551)

Table 1: Mixed logit estimation (Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1)

Table 1 displays mixed logit estimates of the random coefficients which allow for heterogeneity in consumer valuation.

All coefficients are statistically significant, except Mobile Data and Triple Play_Unlimited interaction. The standard deviation coefficients are statistically significant for three variables: price, Triple Play and voice. The standard deviations are particularly significant for Triple Play, with SD equal to 5.2 for a mean value of 7.8. This indicates that consumer valuation of fixed service is highly heterogeneous. The interaction between the fixed broadband and mobile data components (Triple Play_Mobile Data_Smartphone) has a significant positive coefficient. This suggests that fixed and mobile data are complementary, provided that the consumer owns a smartphone.

The estimated coefficient of the exogeneity control variable is statistically significant. The endogeneity correction of the dummy variable indicating of smartphone ownership is justified by the control function.

We will discuss the distribution of Price and Triple Play below in more detail, using individual-level parameters (Train 2009).

5.1 Price coefficient distribution

As reported in Table 1 the estimate of price coefficient $(-\alpha_i)$ is negative and statistically significant both for the mean value and its standard deviation. The distribution of price coefficient was specified to be normal. The Figure 2 illustrates the distribution of the price coefficient for mobile-only consumers and FM consumers by using individual level parameters.

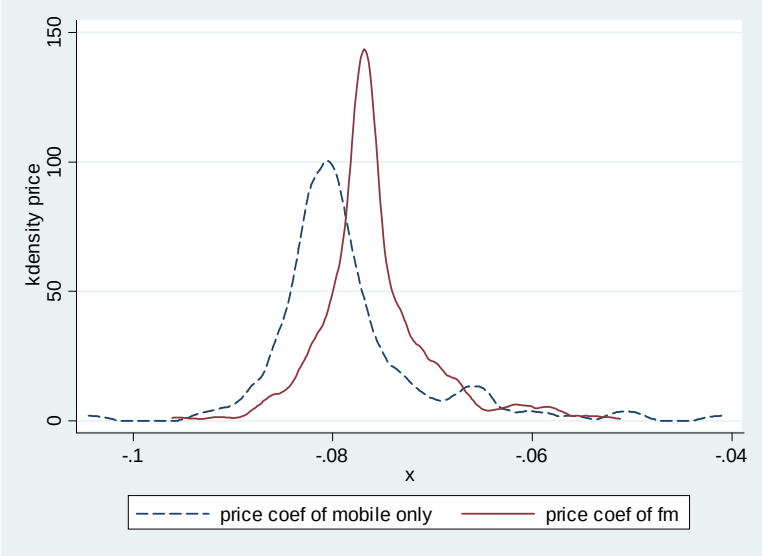

Figure 2: Price coefficient for two subpopulations: mobile-only and fixed-mobile consumers

The price coefficient for mobile-only users is significantly more negative than for FM consumers which suggests higher price sensitivity among the former. Consequently, an increase in the fixed offer price would depress the demand for fixed services among mobile-only users.

5.2 Fixed component coefficient and consumers' WTP

The estimate of the coefficient of the dummy variable for fixed component Triple play β_i^f is also statistically significant for both the mean value and its standard deviation.

Figure 3 indicates that the mean value of fixed component coefficient is lower for mobile-only consumers (˜0.7) than for FM consumers (˜8.8). This result provides the main explanation of mobile-only consumption behavior.

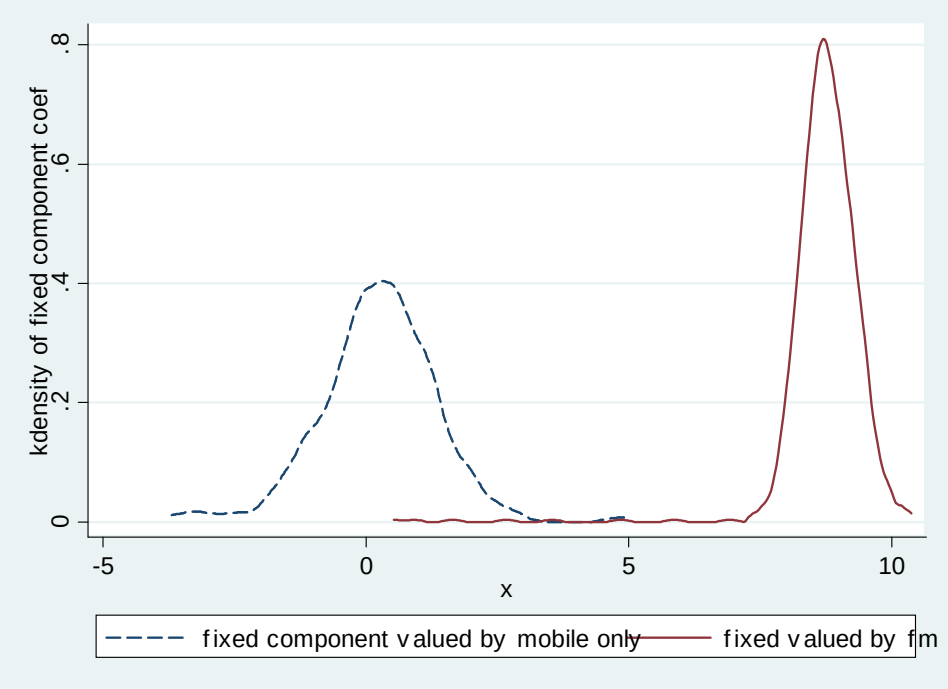

Figure 3: Distribution of fixed component valuation for two subpopulations: mobile-only and fixed-mobile consumers

This result implies that mobile-only users do not value fixed broadband highly enough to be inclined to subscribe to an additional fixed broadband offer.

The analysis of the respondents' willingness to pay provides the same insight. Recall that WTP is calculated by dividing the valuation of a given service by the price coefficient. As Figure 4 shows, mobile-only users have a far lower WTP for fixed broadband than do fixed-mobile users. Calculations on the individual-level parameters for Price and Triple Play coefficients reveal that mobile-only users have an average WTP for fixed broadband of €15 per month, whereas their fixed-mobile counterparts have a WTP of €124.

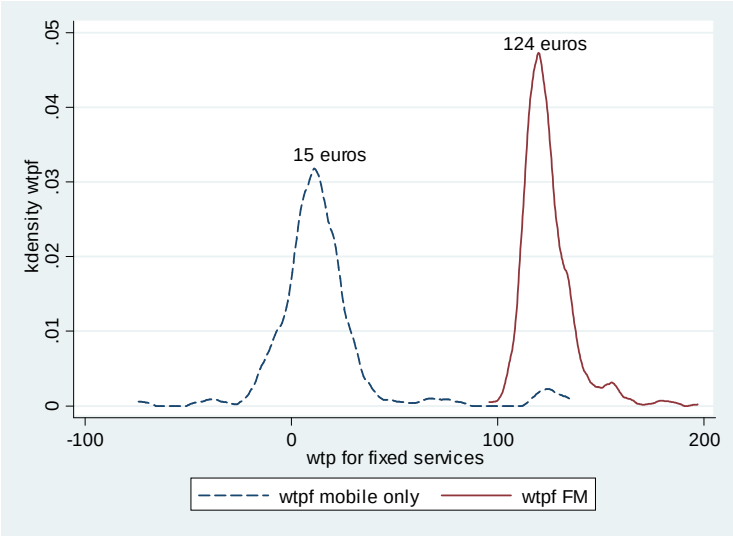

Figure 4: Willingness to pay for fixed component by mobile-only users

It should also be noted that fixed broadband serves the whole household, while a mobile subscription is usually used only by the subscriber. Thus, in order to put both WTP levels on a comparable scale, the WTP for fixed-mobile users is divided by the average household size. In the present study, average household is three, for a WTP per individual of approximately €41. Hence, on an individual basis, fixed-mobile users have a WTP for fixed broadband which is three times higher than mobile-only users [6].

[6] According to CREDOC (2014), mobile-only consumers (10% of the population in 2014) are on average younger: 55% are under 40 years instead of 41% in the general population. One notes a male overrepresentation (53%, +5 points compared to the general population). It's also about people living alone (45%, against 24% in the overall population) and on low incomes (37% against 22% on average). Employees (22%, +6 points) and workers (18%, +7 points) are over-represented in this category. These socio-demographic characteristics may contribute to explain the difference in WTP for fixed component which is shared among more users in a multi-person household than a one-person household.

5.3 Fixed mobile data interaction

The model specification includes an interaction term between the fixed broadband and mobile data components (Triple Play_Mobile Data_Smartphone). Its purpose is to study the substitution versus complementarity between both broadband components.

Table 1 in main results shows that the mean value of the relevant variable is statistically highly significant and positive.

Figure 5 indicates that the coefficient of the FM data interaction variable is positive and has a similar value for mobile-only consumers and FM consumers. Both broadband components are thus complementary. This result contradicts the results found for voice services, since several studies have revealed a pattern of substitution for voice.

The results indicate a statistical insignificant standard deviation, implying that both mobile-only and fixed-mobile users see fixed and mobile broadband as complementary.

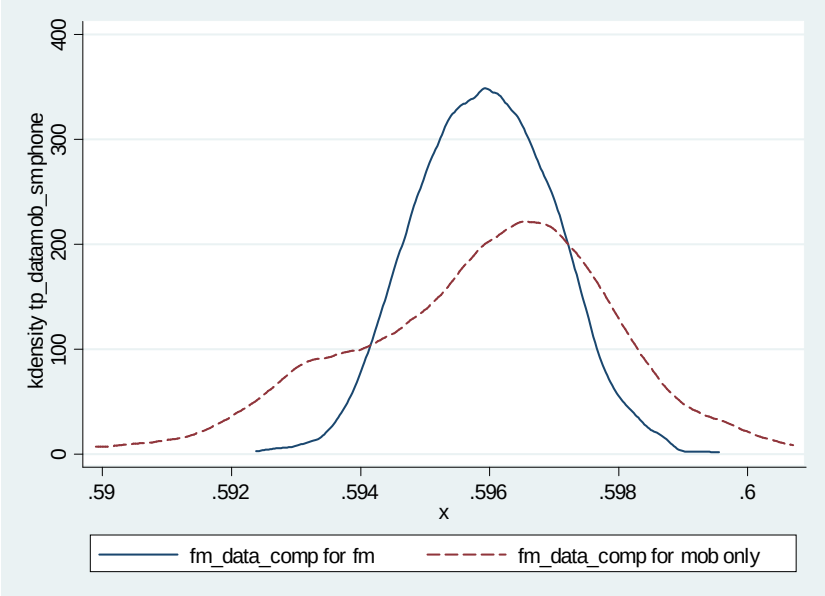

Figure 5: Distribution of the Fixed-Mobile interaction term

It can thus be deduced that the existence of mobile-only users is due to the factors described

above, namely higher price sensitivity and a lower fixed broadband valuation by mobile-only users.

The complementarity between the broadband components also has a positive impact on respondents' WTP for fixed broadband. Since both components are complementary, consumers with increasing data usage could be induced to subscribe to an additional fixed offer in order to meet their consumption needs. This aspect is reflected by WTP per GB included in the mobile plan. Dividing the coefficient Triple Play_Mobile Data_Smartphone by the price coefficient yields a WTP per GB included in the mobile offer of €8.4 (cf. Table 1 8.4=0.625/0.074). An increase in the mobile data allowance could thus induce some mobile only users to subscribe to an additional fixed broadband service. To this end, increasing the mobile data allowance by approximately 2 GB would suffice. Given that mobile-only users' basic WTP for fixed broadband is approximately €17, and given a potential increase of €8.4, it can be inferred that mobile-only users' WTP for fixed broadband could exceed the most popular fixed service price of €30 if the mobile data allowance were increased by 2 GB.

5.4 Simulations with zero or very high fixed component price

This section extends the analysis to simulations on the consumer choice model. The aim is to identify the variation in consumers' choices when facing significant variations in the price of fixed broadband.

To that end, focus is laid upon the direct utility of the fixed component from equation 1 (that is, $U_f = \delta_f \beta_i^f + \gamma_{fm} FMint - \alpha_i p^f$, relative to the fixed component and its positive interaction with mobile data). The remaining components of equation 1 are left unchanged. Two extreme scenarios are considered: either fixed broadband is offered for free, or the price for fixed broadband is €150. Each scenario is analyzed with and without switching costs. This

approach allows us to identify the additional utility that the fixed broadband component can potentially bring to mobile-only consumers.

Figure 6 illustrates the baseline scenario, i.e. without any modification of equation 1. It shows that the positive interaction term is insufficient for mobile-only users to subscribe to a fixed broadband offer. Thus, despite the complementarity, the additional utility of fixed broadband is negative.

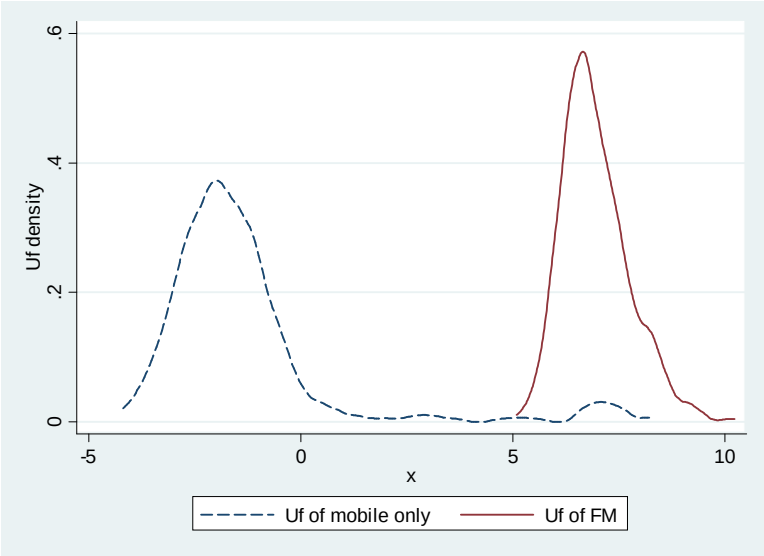

Figure 6: Distribution of utility of the fixed component for mobile-only and fixed-mobile consumers

In the first scenario, the fixed broadband price is equal to 0. Predictably, additional utility for mobile-only users increases sharply, as shown in Figure 7. The percentage of mobile-only users therefore drops by nearly 50 % (from 15 % in the baseline scenario to slightly above 8 % in December 2012) Moreover, as shown in Figure 8, if consumers were exempt from any kind of switching costs, the number of mobile-only users would decrease further.

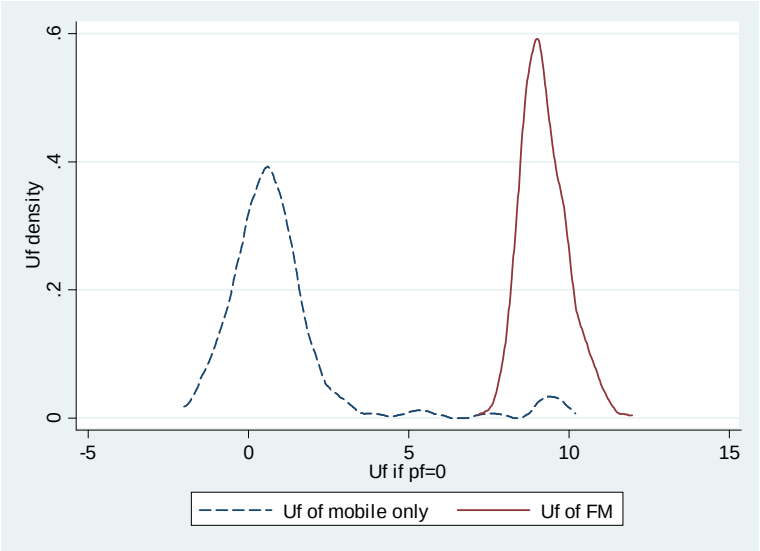

Figure 7: Case of pf=0, Distribution of utility relative to fixed component for mobile-only and fixed-mobile consumers if the price for fixed service is zero

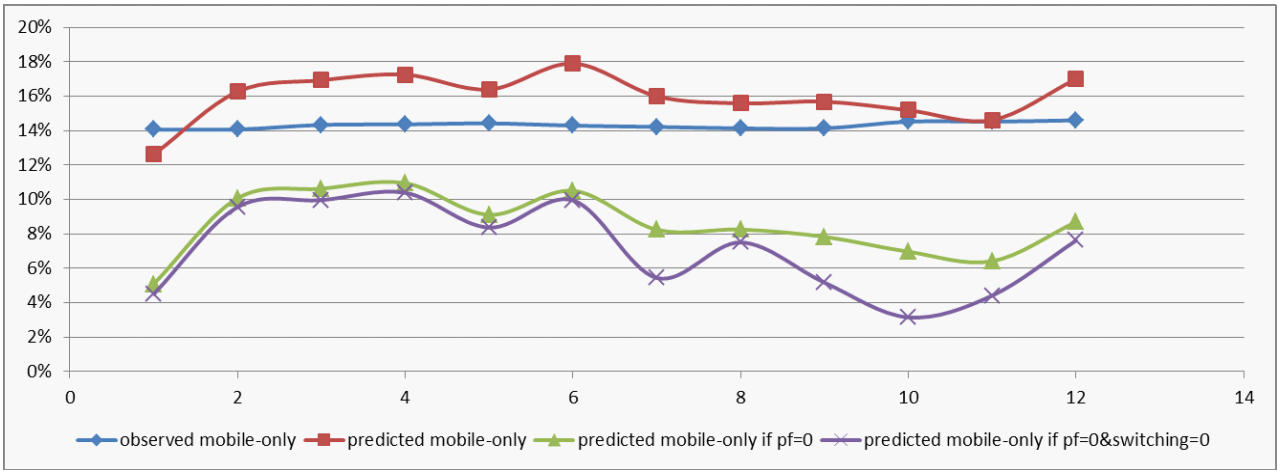

Figure 8: Case of pf=0, Simulated mobile-only subscription rate in different scenarios

Then consider the second scenario, with a fixed broadband price of €150. If the price is prohibitively high, the additional utility of fixed broadband would be negative for nearly 100 % of the respondents (cf. Figure 9, in this case, the percentage of mobile-only users would be 7

points higher compared to the baseline scenario. This can be seen in Figure 10).

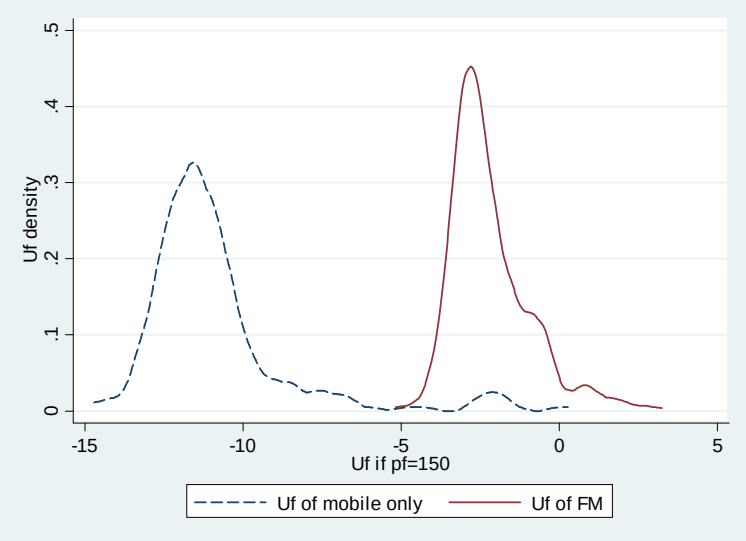

Figure 9: Case of pf=150, Distribution of utility relative to fixed component for mobile-only and fixed-mobile consumers if the price for fixed service is equal to 150€

Figure 10 also reveals that switching costs have a considerable impact on the simulated mobile-only subscription rate. If switching costs are set to 0, nearly 90 % of respondents would switch their communications services provider.

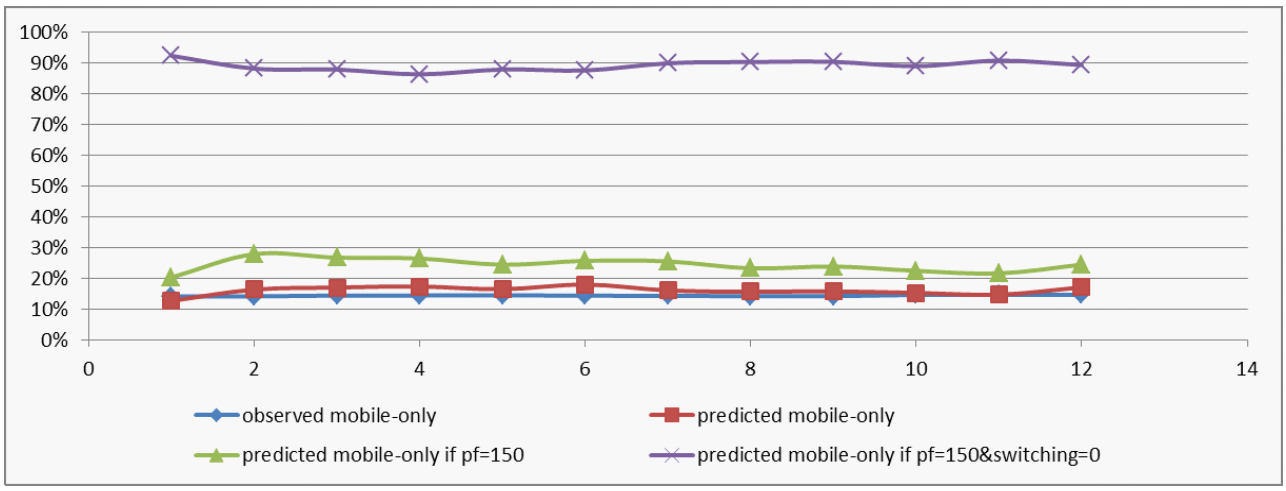

Figure 10: Case of pf=150, Simulated mobile-only subscription rate in different scenarios

6 Conclusions

Mobile-only consumers are often said to be the result of the ongoing fixed-mobile substitution process. The existing literature has, in fact, consistently shown that consumers can satisfy their voice service consumption needs with their mobile offer alone. When it comes to broadband, however, this finding could be reversed.

This study aims to assess whether fixed and mobile broadband are complementary. Consumer level data has been fitted in a mixed logit model that includes an interaction term representing the relationship between fixed and mobile broadband. The corresponding coefficient was positive, implying that the two types of broadband access complement each other. This result holds for France which, due to its extensive fixed and mobile network coverage, is in a very different situation than countries such as Sweden.

Despite the complementary nature of the two services, the additional utility generated by fixed broadband appears insufficient for mobile-only users to subscribe to a fixed broadband offer as well. These results can be explained by two underlying facts. First, mobile-only users show higher price sensitivity than fixed-mobile service users. Second, mobile-only users have a

low valuation for fixed broadband. The estimation of consumers' willingness to pay for fixed broadband showed that mobile-only users have a low WTP for this service, namely €15 per month, half the most common monthly fixed broadband fee of €30.

However, some consumers are unconditional mobile-only users. Simulations on the estimated model showed that even if fixed broadband was offered for free, the average mobile-only consumer rate would still be around 7 %. Other simulations also showed that if the fixed component came at a prohibitively high price, the mobile-only subscription rate would not exceed 30 % of the population. This is due to the switching cost incurred when switching to a new offer or another operator, which depends on the consumer's contact length.

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