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Mobile-only consumers arise from heterogeneous valuation of fixed services

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November 2015

Abstract

Mobile-only users are usually considered as a consequence of fixed-mobile substitution. Via a unique dataset based on a a large European country survey and consumers' invoice data, this study reveals heterogeneous preferences for fixed services among consumers. The data is fitted in a mixed logit model and willingness to pay (WTP) for fixed communications services are estimated. Results show that mobile-only consumers have a WTP for fixed services of 15 € per month, while the WTP of users of both fixed and mobile services is thrice higher. Considering that a typical monthly fee for fixed services is around 30 €, the heterogeneous preferences for fixed services constitute an alternative explanation for the existence of mobile-only users, despite the complementarity 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 is quite well documented in voice matters. However, the relation between fixed and mobile still rather unclear and appears even different. In effect, many consumers use both types of connection. At home, the fixed broadband service is rather uncontested because of its connection speed and (mostly) unlimited data volume. By definition though, fixed services are not usable when the consumer is outside the range of its WiFi connection[1]. Thus, there appears to be an intuitive complementarity between fixed and mobile broadband services. The related literature on the relation between fixed and mobile broadband is yet still humble. Therefore, the aim of this paper is first of all to assess this complementarity.

Mobile-only consumers are more common in the US than in France. Indeed, the US count almost 40 % of mobile-only consumers among its population while the French population only exhibits quarter as much mobile-only users. The explanation provided in this paper relies on the heterogeneity of consumers' preferences for fixed services. Estimation of the willingness to pay (WTP) for fixed communication services of French consumers reveals a much higher WTP for consumers having subscribed to fixed as well as mobile services than their mobile-only counterpart. Thus, given the fact that fixed services are much more expensive in the US than in France, mobile-only consumers are more common in the US.

The French market for communication services has indeed showed impressive dynamics in terms of prices, mostly driven by competition in the market. For instance, some quadruple play offers, released in 2009, provided consumers with a real incentive to combine their fixed and mobile offers, since the offer came with a discount up to 16 € compared to the sum of stand-alone prices. Evidently, the other market players followed this trend in order to reduce their churns. The French market has an appreciable quadruple play penetration, namely 24% in 2015, in second position in Europe after Belgium (27%).

Despite highly competitive pricing schemes, the market dynamics is also nourished by tech-

[1] One could consider WiFi Hotspots that are deployed in many public places. However, they do not offer as much ubiquity as mobile networks.

nological evolutions. The adoption of IP technology within the fixed and mobile core network, as well as the deployment of optical fiber for the traffic backhaul of mobile base stations, led to the replacement of traditional voice networks with data networks. This technological transformation, which was observed in the fixed network in the early 2000s, allows operators to provide voice over IP (VoIP) as a basic and 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, and is being taken over by mobile data. However, the scarcity of mobile network resources does not allow carriers to offer unlimited data volume on mobile plans, unlike fixed broadband technology. Therefore, fixed broadband services provide added value over mobile services in terms of data volume, which may explain the important share of consumers using both networks.

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

The consumption behaviors constitute the central point of this study which introduces a micro-econometric model. Survey data of French interviewees combined with their detailed billing data is fitted in a conditional mixed logit model. The individuals are confronted with three alternative consumption choices: i) using only a mobile offer, ii) complementing their mobile offer by one stand-alone fixed offer or iii) subscribe 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.

2 Literature Review

The relevant existing literature to be reviewed here focusses on the characteristics of demand for telecommunications services. Early academic literature on this issue (in the 1970's) was most

often concerned with the estimation of demand elasticities with respect to prices in times of high inflation and upward pressure of call rates (Taylor, 2002). With the increasing popularity of mobile services and thus the upcoming substitution between fixed and mobile services, the literature also considered to integrate non-price factors, like socio-demographic ones, to profile the consumers conditional on which service they use.

As for telephony services, Rodini, Ward and Woroch (2003) use a logit model in order to estimate cross-price elasticities between fixed and mobile voice services. Their study relies on microlevel data from 2000-2001 in the US. Besides significant impacts of usage, as well as access and prices, the authors also find that socio-demographic variables such as income, education or household size have a positive impact on the probability of mobile subscription, to the detriment of second fixed line subscription. In contrast, the older the surveyed person, the less high the probability of subscribing to a mobile voice service.

Following a similar idea, Ward and Woroch (2004) analyse substitution patterns in the US during 1999 to 2001 and conclude that non-price factors like mobile network coverage and quality also plays a major role in mobile subscription take-off. Using data from 2004 to 2006, Schejter et al. (2010) performe a cluster analysis on wireline and wireless market segments separately in order to identify the characteristics of consumers belonging to either segment. Their results reveal that wireless users are predominantly young people with low income. Moreover, house owners are more likely to be fixed line users. The authors also conclude that mobile-only consumers are newcomers to the markets, reflecting the emergence of a new consumer and not as an expression of switching by an existing one. Macher et al. (2010) empirically estimate a consumer choice model using household-level observations from 2003-2010 and find that subscription to fixed and mobile telephony are substitutes rather than complements. Grzybowski & Verboven (2014) find significant fixed-mobile voice substitution with substantial heterogeneity across households and EU regions. Their paper reveals also that the decline in fixed telephony has been slowed down because of a significant complementarity between fixed-line and mobile connections offered by the fixed-line incumbent operator.

With the emergence of broadband Internet access, several studies focus on estimating the demand for the different Internet access technologies and deriving consumers' willingness to pay for different component of the available offers. For instance, Savage and Waldman (2005) provide evidence that subscribing to a high speed broadband connection is more likely for high income household and persons with higher education. Moreover, they show that people's online experience is an influencing factor, too.

In Rosston, Savage and Waldman (2010), the authors design a discrete choice experience to show that consumers willingness to pay of Internet service improvements like increase Internet connection speed. In particular, their results reveal that US citizens are willing to pay 3 $ more in order to enjoy very fast Internet rather then fast Internet. This is an interesting result as it raises the question of whether deploying a nationwide optical fiber network is economically justifiable.

Broadband access demand estimation in Europe also identifie, among others, income, education and household size as variables that influence consumers' decision process. For instance, Srinuan, Srinuan and Bohlin (2012) illustrate these findings for Sweden using data from 2009 and Cardona et al. (2009) analyse the Austrian market with 2006 data. The former show that swedish people with a low income have a higher probability of using mobile broadband rather than fixed (fiber or DSL), whereas this probability is less high in rural areas. A similar result is found for the Austrian market: people living in Vienna are more likely to subscribe to a mobile broadband offer. Educational considerations, however, seem to play less important role in Sweden than in Austria.

Also relevant are the reports issued by governmental instances like national regulatory authorities, consulting agencies national research centers. For instance, a report issued by DotEcon (2001) studies fixed-mobile substitution in 2001 and drew consumer profiles for UK mobile-only consumers, fixed-only users, and fixed and mobile users. A similar study is produced in France by CREDOC (2014) or at European level by the Eurobarometer reports.

Both studies basically provide the same insights: single-service usage is influenced by low

income (for mobile-only usage) or higher age (for fixed-only usage). However, these studies mostly provide inventories and descriptive statistics on the phenomenon discussed here, rather econometric analysis.

The major contribution of this paper is the usage an original dataset of more than 1000 consumers during the period spanning from January to December 2012. The results are different from those described in the existing literature. There are two reasons behind mobile-only consumers: their higher price sensitivity and lower valuation of fixed services. Each consumer has to take a decision to either buy two complementary goods or to take only one of them. However, one of them is less valued and some consumers exhibit a highly price sensitivity. Therefore, if a customer is not willing to pay the fixed component monthly fee in addition to the mobile fee, especially for low income people, the consumer prefers to become mobile only user.

3 The Data

The data stems from the GFK Institute for surveys and covers the period from January to December 2012. During this period, 1069 consumers have been reached on their cellphone and asked to indicate which means for electronic communications they use on a private basis. The present study uses these indications in order to determine whether the consumer is mobile-only. In particular, the respondent is considered as mobile-only if she uses only a mobile plan to satisfy her consumption needs.

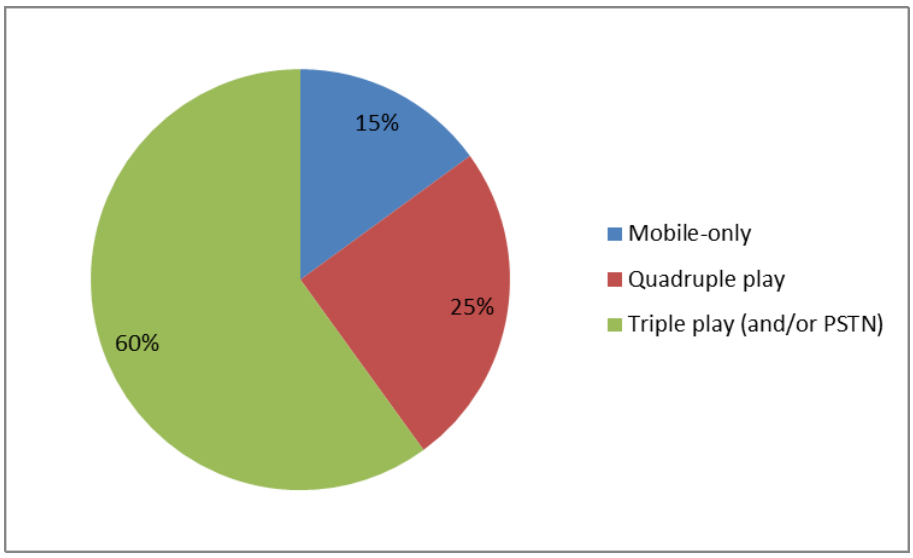

Figure 1: The distribution of consumption type in december 2012

The pie chart in Figure 1 shows the distribution of the 1069 respondents following three types of consumers in December 2012: mobile-only (15%), fixed-mobile with separate fixed and mobile services subscriptions (60%) and quadruple play (25%). Among the respondents that have separate fixed and mobile service subscriptions, two groups can be distinguished: i) fixed-mobile users having PSTN services without broadband access and ii) fixed-mobile users have (mostly) a triple-play offer and a stand-alone mobile offer.

The GFK survey collected some consumer characteristics data such as age, gender, number of children living at home, the occupational status, and the residential municipality. For each municipality, French national statistic office provides the population density and the median household revenue.

We collected also two others datasets for the GFK survey respondents. These datasets include information about the respondent's monthly bill, characteristics of the mobile and/or quadruple play offer and the type of handset used during the period under investigation.

Unfortunately, not all of the respondents provided information about their fixed monthly bills. However monthly fee for mobile services and quadruple play offers are exactly observed

in the dataset. For consumers a mobile offer combined with a separate fixed offer, a monthly fee of 30 € is added[2], which corresponds to the most popular Triple-play price observed on the French market.

Following descriptive statistic, mobile only consumers are more common among low income household, jobless and/or young people and people without children.

As usual in choice models, consumers must be confronted with a set of choice possibilities. This study's choice set is build in similar way as in Grzybowski & Liang (2015). For each month from January to December 2012, the consumer can choose one alternative among:

(i) keep the offer as in the previous month; (ii) switch to a new mobile offer from the list of offers available in 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; (v) leave for another mobile operator but keep fixed services for fixed-mobile consumers, resp. nothing when the respondent is mobile-only.

4 Empirical model and identification strategy

The model used in this study is one of discrete choice. In such a model, a decision maker faces a set of exhaustive and mutually exclusive alternatives among which she chooses one and only one. There are up to 69 different alternatives available to consumers each month in the time period considered.

Discrete choice models rely either on a logistic distribution of choice probabilities. Among these models, it is convenient to distinguish between *multinomial* logit model, where the exogenous variables vary with the individuals (e.g. age, occupational status, etc.), and *conditional* logit model, where the exogenous variables vary with the alternatives in the choice set. Prices

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

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

are the archetype of a variable in a conditional discrete choice model, but the data allowance in mobile subscriptions (which may differ from one offer to another) can also be cited.

There exists also the possibility of some mix of the multinomial and conditional model. In this case, the set of exogenous variables contains both alternative-specific and individual-specific variables. However, these models should not be confounded with the *mixed logit*, which allows to take into account the heterogeneity between individuals. The study uses both alternative-specific and individual-specific variables. In order to be able to estimate such a model, the individual-specific variable have to be coded as alternative-specific variables, i.e. induce variability for variable like Smartphone (indicating 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 relative to a mobile offer is $V^m_{ijt} = x'_{jt}\beta^m_i - \alpha_i p^m_{jt}$ and relative to a fixed offer and also 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.

Therewith, we include interaction terms of a dummy for fixed component with a dummy

[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.

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 minutes and fixed component.

The vector of switching dummies is denoted , in the same way than Grzybowski & Liang (2015), by s'_{ijkt} and 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:

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

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

A mixed logit model allows for unobserved consumers' 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, focus is put on the interaction terms regarding the dummy for fixed component included in fixed-mobile combined offer[5].

Moreover, the interaction between fixed and mobile does only make sense if a consumer owns a smartphone which enables the usage mobile data services. However, owning a smartphone is endogenous due to its correlation with unobserved characteristics of each individual that can influence the decision. To deal with this endogenity issue, the dummy variable smartphone is instrumented with the density of respondent's residential municipality. Via a control function approach (Petrin and Train 2010), a control variable is included in both for conditional logit and mixed logit regressions. To introduce variability in the choice sets, the dummy variable smartphone is interacted with the handset subsidy option associated to 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, list price, handset subsidy option, dummies for 12 and 24 months

[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 minuted when the voice allowance is not unlimited, mobile data allowance in GBytes, (ii) dummy variable for fixed broadband triple play, (iii) dummy for leaving which corresponds to 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 the interaction Triple Play_Unlimited. The coefficient for the standard deviations are statistically significant for three variables: price, Triple Play and voice. The standard deviations of Triple Play is especially important, with SD equal to 5.2 for a mean value of 7.8. This result indicates that the consumers' valuation for fixed service is highly heterogenous. The interaction term between fixed broadband component and the mobile data component (Triple Play_Mobile Data_Smartphone) has a positive and significant coefficient. This results suggests that fixed and mobile data are complements provided that the consumer owns a smartphone.

The estimate of the coefficient of the control variable for exogeneity is statistically significant. The correction of endogeneity of dummy variable indicating the possession of smartphone is justified by the control function.

We will discuss below in more detail the distribution of Price and Triple Play by 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.

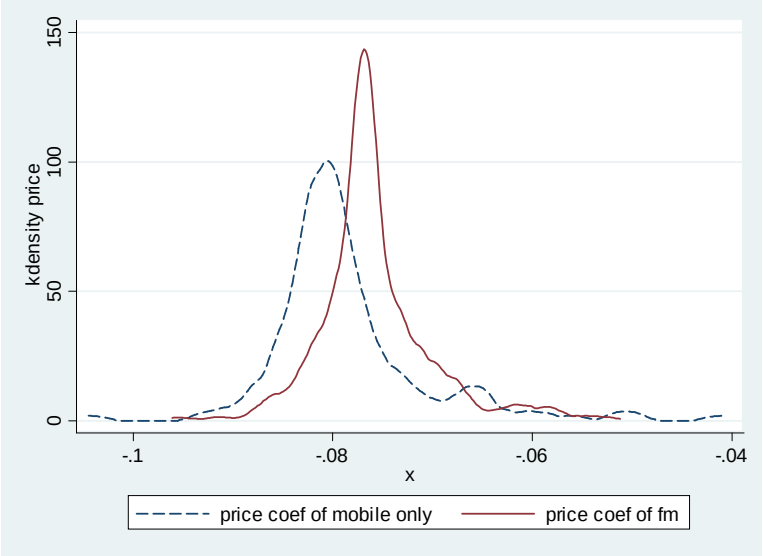

Figure 2: The distribution of the price coefficient for two subpopulations: mobile-only and fixed-mobile consumers

The price coefficient for mobile-only users is significantly more negative than for FM consumers which suggests a higher price sensitivity of the formers. Consequently, an increase of the fixed offer price would depress the demand for fixed services stemming from 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 both for 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.

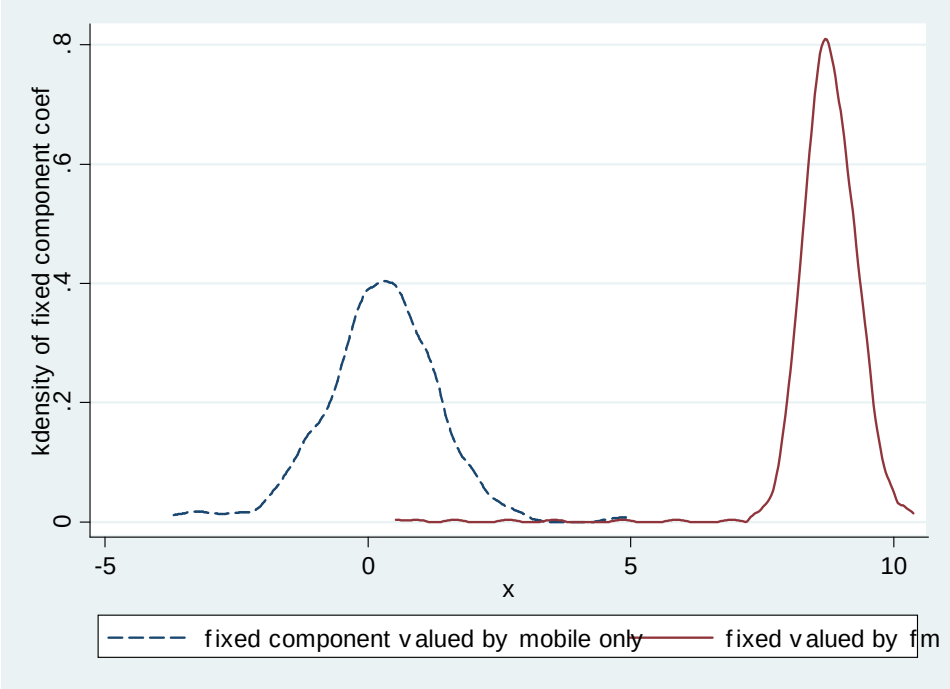

Figure 3: The distribution of the valuation of fixed component for two subpopulations: mobile-only and fixed-mobile consumers

This result implies that mobile-only users do not value fixed broadband sufficiently high so as 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 the WTP is calculated by dividing the valuation of a given service by the price coefficient. As the Figure 4 shows, mobile-only users have a far lower WTP for fixed broadband than fixed-mobile users. Calculations on the individual level parameters for Price and Triple Play coefficients reveal that mobile-only user have, in average, a WTP for fixed broadband of 15 € per month, whereas their fixed-mobile counterpart have a WTP of 124 €.

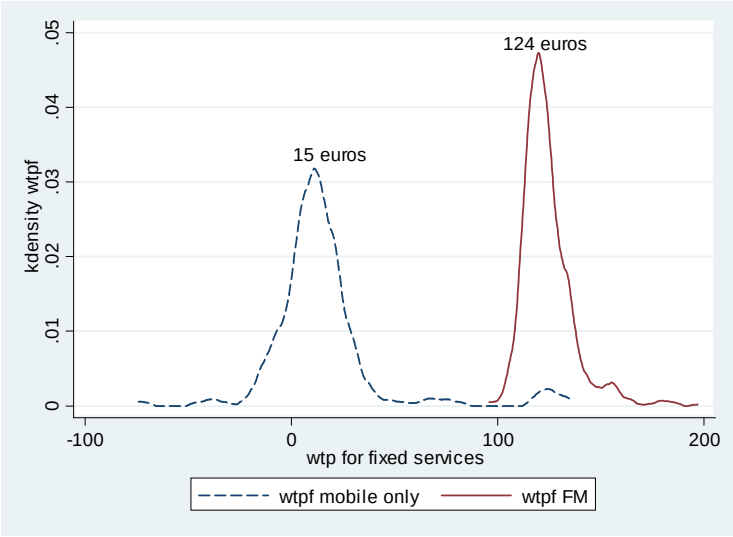

Figure 4: Willingness to pay for fixed component by mobile-only users

It should also be noted that fixed broadband serves the whole household while a mobile subscription is usually used by the subscriber only. Thus, in order to put both WTP on a comparable scale, the WTP for fixed-mobile users is divided by the average household size. In the present study, an average household counts three heads, which leads to a WTP per individual of approximately 41 €. Hence, on an individual basis, fixed-mobile users have an WTP for fixed broadband 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 fixed broadband component and the mobile data component (Triple Play_Mobile Data_Smartphone). Its purpose is to study the complementary resp. substitutability 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 similar value for mobile-only consumers than for FM consumers. Thus, both broadband components are complementary. This result is contrary to the results found in telephony matters. Indeed, regarding voice service, several studies have revealed a substitutional pattern.

Regarding the standard deviation, the results indicate a statistical insignificance, implying that both mobile-only and fixed-mobile user see fixed and mobile broadband as complementary.

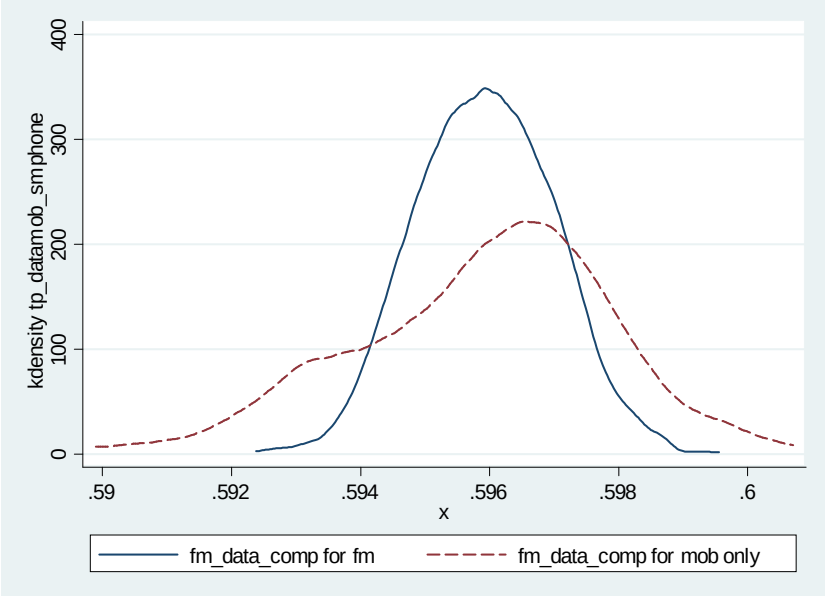

Figure 5: Distribution of the Fixed-Mobile interaction term

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

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

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

5.4 Simulations with zero or very high fixed component price

This section extends the analysis to simulations on the consumers' choice model. The aim is to identify the variation the consumer's choice incurs when facing significant variations of the price for 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 the fixed broadband is offered for free, and thus , 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 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.

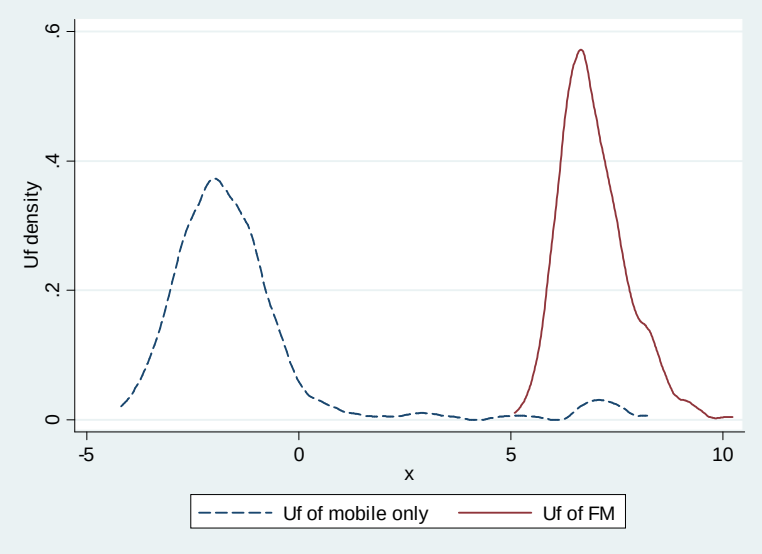

Figure 6: Distribution of utility relative to fixed component for mobile-only and fixed-mobile consumers

In the first scenario, the fixed broadband price is equal to 0. Unsurprisingly, mobile-only users incur a sharply increased additional utility, as Figure 7 shows. The subscription rate of mobile-only users therefore drops by nearly 50 % (from 15 % in the baseline scenario to slightly above 8 % in December 2012) Moreover, as is reported on Figure 8, would consumer be exempt of any kind of switching costs, the number of mobile-only users would become even less.

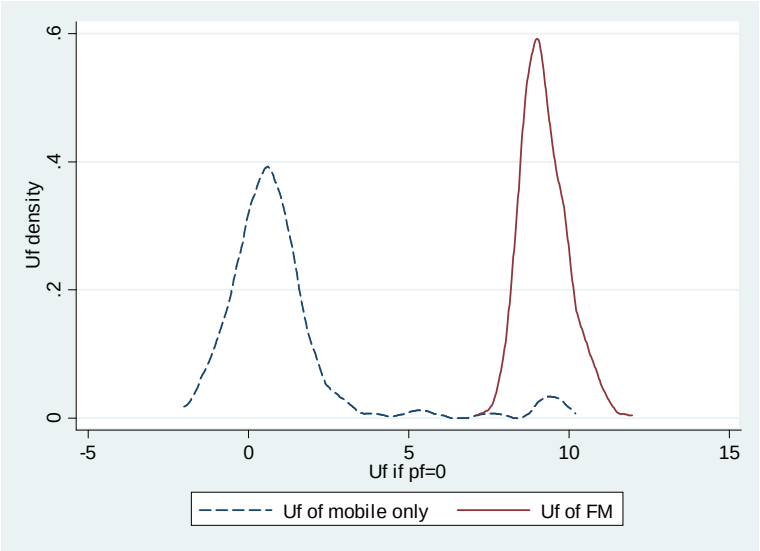

Figure 7: Case of pf=0, Distribution of utility relative to fixed component for mobile-only and fixed-mobile consumers if the price for fixed service is zero

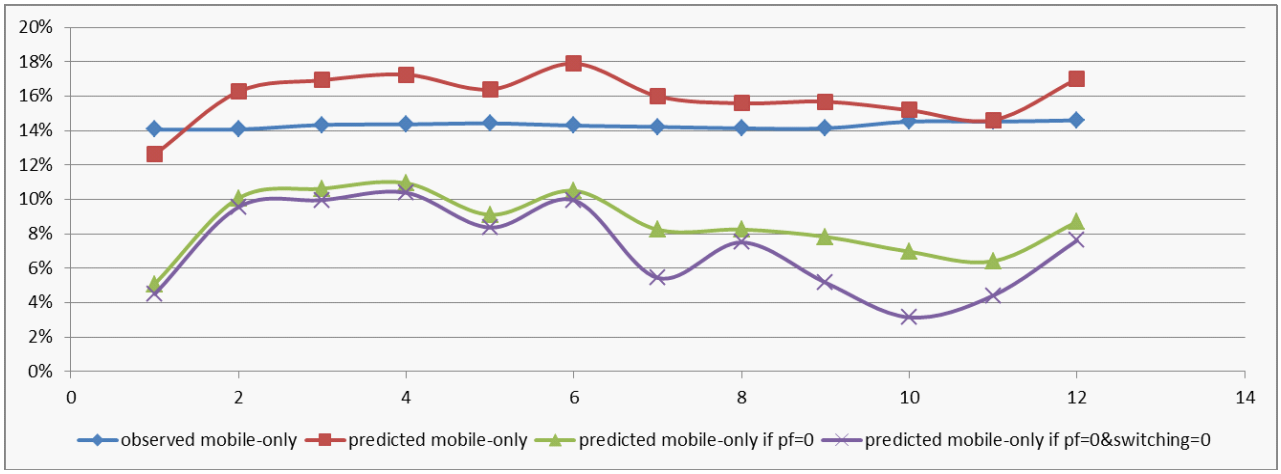

Figure 8: Case of pf=0, Simulated mobile-only subscription rate in different scenarios

Consider next the second scenario with a fixed broadband price equal to 150 €. Would be this prohibitively high, the additional utility of fixed broadband would be negative for nearly 100 % of the respondents (cf. Figure 9, in this case, the subscription rate of mobile-only user

would be 7 percentage points higher compared to the baseline scenario. This can be seen on Figure 10.

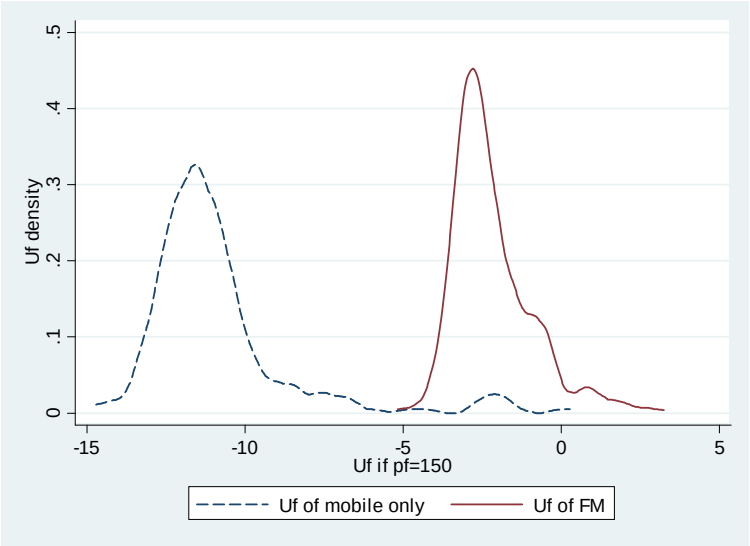

Figure 9: Case of pf=150, Distribution of utility relative to fixed component for mobile-only and fixed-mobile consumers if the price for fixed service is equal to 150€

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

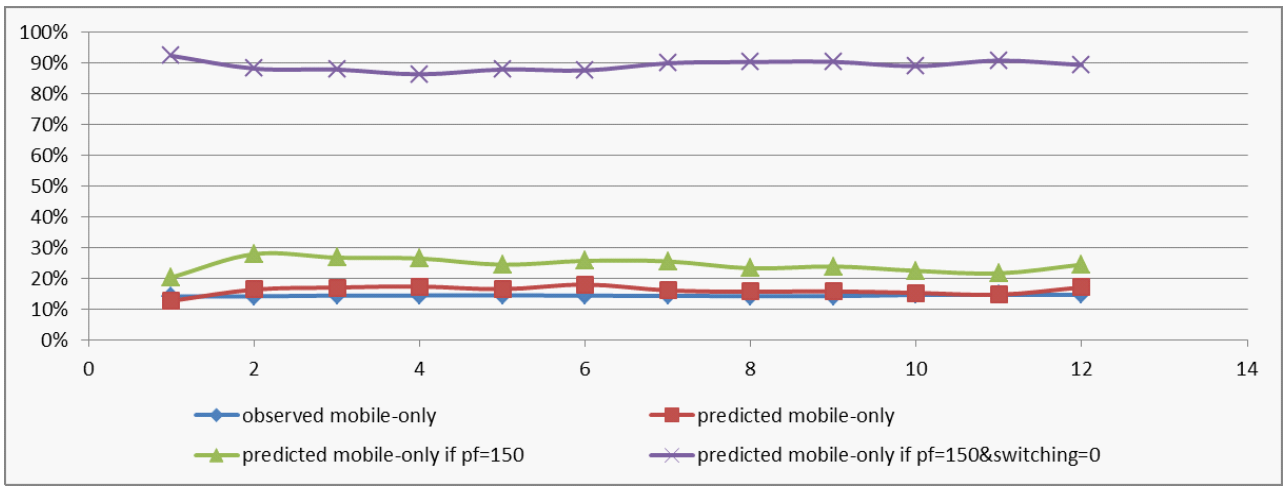

Figure 10: Case of pf=150, Simulated mobile-only subscription rate in different scenarios

6 Conclusions

Mobile-only consumers are often said to be the result of the ongoing fixed-mobile substitution. The existing literature has in effect consistently revealed that consumers are able to satisfy their consumption needs with their sole mobile offer when it comes to telephony services. With regards to broadband, this finding could be reversed.

This study aims also to assess that fixed and mobile broadband are complements. Consumer level data has been fitted in a mixed logit model that includes an interaction term representing the relation between fixed and mobile broadband. The corresponding coefficient turned out positive, implying that both broadband accesses are complementing each other. This results holds for France which, due to extensive coverage of its fixed and mobile networks, does not face the same circumstances as, for instance, Sweden.

Despite this complementarity, the additional utility stemming from fixed broadband appears insufficient for mobile-only users to subscribe to a fixed broadband offer as well. The results can be explained by two underlying facts. First of all, mobile-only users incur a 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 €. This amount can be put in relation with 30 € which corresponds to the most popular monthly fee for fixed broadband.

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

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