Research Article

DETERMINANTS OF THE DIVERSIFICATION OF TELEVISION ACCESS PLATFORMS IN HOUSEHOLDS IN CAMEROON

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Abstract

In a television environment marked by the proliferation and coexistence of television access platforms, several studies are limited to analyzing the determinants of the adoption of a single platform in households. The objective of this study is to examine the determinants of the diversification of television access platforms in Cameroon, based more specifically on the theory of consumer choice. To achieve this, the study uses primary data from a survey carried out in April by the Department of Economic Policy Analysis of the Faculty of Economics and Management of the University of Yaoundé 2 Soa. The study uses Multivariate Probit, which allows to model simultaneous adoption, and Ordered Probit for the analysis of the level of access to television. The results reveal that television platforms are perceived as substitutes in the eyes of consumers. However, their association is favoured by user preferences and offer prices in accordance with the traditional theory of consumer choice. The Cameroonian government must implement a set of mechanisms aimed at reducing the heterogeneity of the content offered and encouraging households to only go to the platform that best suits their preferences.

Key words: Determinants, Diversification of platforms, Television, Households, Cameroon.

INTRODUCTION

On the empirical level, the phenomenon of multiple adoption is the subject of analyses in several Information and Communication Technologies (ICT) sectors such as mobile telephony [2, 3, 36] or social networks [22]. Analyses in this direction remain non-existent in the television sector, where most of the work, especially the most recent one, is limited to the analysis of the determinants of the adoption of a platform in the context of a single access [32, 51, 5, 48]. However, in a television environment marked by the multiplication and coexistence of television access platforms, it is not uncommon to observe the multi-reception of television within a home [4]. Two out of three households combine different TV access platforms, including terrestrial TV, cable, satellite, Asymmetric Digital Subscriber Line (ADSL) and Digital Terrestrial Television (DTT) [10, 11]. These platforms are not exclusive of each other [9]. In reality, even if these competitive platforms have the specificity of offering services that are similar in nature, they still differ slightly in their characteristics [24, 23]. Indeed, the competitive dynamism means that we observe a differentiation of the offers of publishers and broadcasters, which is mainly manifested by the diversity and exclusivity of content, as well as by attractive pricing models. Broadcasters seek to attract specific audiences and compete with each other by offering unique content such as original series or live sporting events [37]. When it comes to pricing models, broadcasters are innovating to fit consumer budgets. In addition, flexible offers such as pay-per-view subscriptions, family plans and bundles allow consumers to customize their content to their needs [16]. In Cameroon, the phenomenon is becoming more widespread: in 2007, 1% of households with cable television were also equipped with a satellite dish for television reception [18].

Terrestrial television, which has been accessible free of charge since its arrival in 1985, has been distinguished since liberalisation in 2000 [14] by the broadcasting of several local and national channels offered free of charge to viewers but whose image quality is limited. The television channels concerned by this mode of broadcasting mainly offer local programmes focusing on current affairs, culture and national events, reaching a wide audience. On the other hand, pay-TV cable services are divided into two categories: small unlicensed broadcasters offer individual channels, which are less attractive and substitutable in the eyes of consumers and more accessible; They offer a richer experience in terms of content through a wide variety of international and local channels, better image quality, but are still less prestigious than satellite. More expensive satellite broadcasters provide an even more diversified and high-quality offer, extensive coverage often accompanied by pay-per-view channels, exclusive international channels, major sporting events and subscription add-ons or pay-per-view channels with variable payment periodicities. In this context of diversity and differentiation of the offer, households will combine several platforms with the aim of combining the advantages offered by each platform and reaping the maximum possible benefits simultaneously [43]. Several configurations are possible. When there are several active sets in a household, the mode of access to television may not be the same on the main set, the secondary set, or the other active sets [11].In addition, several platforms can coexist on the same workstation and in this case, one platform can be used as the main reception mode. Households will adjust according to their preferences and their available budget by making a trade-off between more economical platforms for everyday content and more expensive platforms for exclusive content. Thus, from an economic point of view, the diversification of television access platforms reflects a model of maximizing utility where individuals choose various platforms to satisfy their needs [39]. They react by becoming more active as they receive information and therefore have

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more time to digest it and revise their initial purchase decision. However, through their choices, consumers aim to exchange immediate benefits and costs for future benefits and costs [15]. This consideration reveals an instability of preferences over time, indicating that individuals do not really know their needs and find it difficult to resist immediate temptations, resulting in the use of services without a full assessment of costs and benefits [21]. Based on these findings in the increasing complexity of consumer choice, this study tests the hypothesis that households will strategically diversify their television access on the basis of their preferences and budget constraints. The present study is important in the sense that it aims to enrich the existing literature, especially in a country like Cameroon, where work in this direction is non-existent. Based primarily on consumer choice theory, the objectives of the study are (1) to identify the different combinations of TV access platforms, (2) to examine the relationship between these platforms, and (3) to empirically examine the roles of preferences and budget constraints as determinants of choice.

LITERATURE REVIEW

Context

Television made its debut in Cameroon in 1985. The first signals are transmitted free of charge to the viewer's receiver thanks to the over-the-air television broadcast by a public television channel, Cameroon Radio and Television (CRTV) by means of an individual antenna. For its operation, the CRTV receives funds mainly from the Audiovisual Licence Fee (RAV) and advertising revenues. The liberalization of the audiovisual sector under the Decree of 3 April 2000 put an end to the State's monopoly and led to the arrival and proliferation of private television channels STV, Canal 2 International, Equinoxe TV, etc. Against a backdrop of technological developments, the arrival of satellite in the late 1980s and early 1990s and cable in the 1990s [17] accentuated this state of affairs through a "multi-chain" offer for which consumers now pay a cost related to network occupancy. There are still differences between the two technologies. While the cable network is physical and poses maintenance and scope problems, the satellite, on the other hand, benefits from a virtual technology that allows access to a larger network. In addition, operators that broadcast by cable are segmented. On the one hand, there are the small conventional cable broadcasters, which are numerous and have a limited offer and at a lower cost, without additional options. On the other hand, there are more structured and few cable broadcasters, which offer a more diversified offer, including channels in High Definition (HD) format, offered in the form of packages, with the bonus of radio channels. For example, major broadcasters such as Créolink TV, TNT Africa, TV+ provide a wide range of local, national and international channels, some of which are in HD grouped in the form of packages, with the additional option of radio channels and Canal+ channels as an option. The business model is based on a fixed monthly subscription, offering several pricing plans depending on the number of channels included and includes the installation of a set-top box provided by the broadcaster. Satellite TV further enriches the TV landscape with a more diverse offering, including exclusive channels not available on cable TV. Four main operators currently share the satellite television market in Cameroon: Canal+ since April 1996 and Startimes, free Africa, TV Sat Africa since December 1996. Canal+, the market leader, offers a wide variety of channels including exclusives,

superior picture quality, and additional features not available in the cable TV offer. In addition, Canal+ is the only one to offer advanced features such as Video on Demand (VoD) through the myCanal application which allows subscribers to watch their favorite programs on demand and store content for later viewing. These offers are particularly attractive to consumers looking for varied and exclusive content. However, access to satellite TV requires the installation of a satellite dish and a specific set-top box provided by the broadcaster, which requires higher subscription fees, which can be a barrier for some consumers.

Because of these significant differences in broadcasters' offerings and the varied needs of consumers, multi-access to television is particularly relevant for households in Cameroon. Integrating different types of broadcasters into a household can offer a complete solution to meet the varied content needs of consumers. For example, a household could choose to use over-the-air television to access local and national channels for free, while using corporate-structured cable television to benefit from a wider variety of channels. To complete this offer, a subscription to a satellite TV service allows access to exclusive events and additional services such as VoD. This approach balances costs while maximizing the diversity of content available. For homes with multiple TV sets, multi-access allows for personalization of the experience to suit the preferences of different family members. For example, each TV set could be equipped to receive different types of services based on the individual preferences of household members, ensuring that each person has access to their favorite content while optimizing costs. Such a configuration would not only meet the diverse needs of each family member, but also improve overall economic efficiency by leveraging the strengths of each type of service.

Theoretical review

One of the main theories for understanding the behaviour of multi-access to television is that of the theory of consumer choice, the analysis of which is based on the principles of individualism and rationality and assumes that the individual knows exactly what he wants and seeks, through procedures derived from his reason, to achieve this objective in the best possible way, taking into account the constraints to which he is subjected [47]. To do this, the economic agent is a being endowed with preferences [38] on the basis of which the individual is able to rank his choices [6], at the end of which he chooses the option with the highest rank in the ranking. In other words, he opts for the choice that gives him the maximum benefit. The relationship between the different platforms thus makes it possible to understand their joint adoption. Two types of relationships are distinguished according to the tastes and preferences of consumers [38]. The first type concerns the substitution relationship where one platform can substitute itself for another to produce identical sensations. In this case, the consumer more or less appreciates the consumption of a platform depending on the circumstances in which he finds himself. The second type concerns complementarity, where the pleasure of one consumption is linked to the pleasure of another consumption. Here, platforms are used together to provide pleasure. It is said that the uses of two platforms reinforce each other. The microeconomic theory is accompanied by the more general theory of uses and gratifications in the understanding of the level of adoption of a media, which corresponds to the microeconomic vision

through the highlighting of the importance of preferences, social needs or psychological states in the behavior of the audience [28, 41]. The basic assumption is that consumers are active rather than passive [1] and therefore make thoughtful and rational choices when making their choices. It is mainly characterized by the motivations and activity of the public [41]. Motivations influence not only the selective and active ways in which individuals seek out and use media, but also subsequent gratification and possible media effects as individuals anticipate and form expectations about media content. Another theory concerns the theory of diffusion of innovations proposed by [40], whose main aim is to explain how a technological innovation evolves from the stage of invention to that of expanded use. Three main elements are identified by the author as the main factors in the adoption of a technology: the characteristics of individuals, the characteristics of technological innovation and the degree of exposure to television.

The characteristics of technological innovation include: (1) relative advantage, which is the degree to which a new platform is perceived to be better than existing ones;(2) compatibility, which measures the degree to which a platform is perceived to be consistent with users' needs; (3) complexity, which measures the degree to which an innovation is perceived to be difficult to understand and use; (4) testability is the ability to test an innovation and modify it before committing to use it; (5) Observability is the degree to which the results and benefits of an innovation are clear at the time of adoption. Network theory, which aims to understand the adoption of a technology in the presence of network externalities [29], is also important. Overall, network goods generate direct and indirect network externalities (or effects), depending on whether we are dealing with a two-lane or single-channel network. Examples of single-channel networks are television broadcasting or television access networks, whose network externalities lie at the intersection between supply and demand and are indirectly related to the variety and quality of supply. In this case, the network effects are twofold: the network effects generated by the platforms combined with the network effects linked to the exclusivity of premium content [33].

In the first case, for cable for example, an increase in the size of the network reduces the average costs, placing the broadcaster in the zone of increasing returns, thus allowing it to make profits and increase its investment and innovation capacities. For satellite, the adoption of the network implies an increase in the size of subscribers, which has the consequence of making the broadcasting platform more attractive through a wider offer of premium content and pay-per-view services [42], thus contributing to the development of value-added products. More specifically, the added value of premium content lies in the fact that it is content broadcast exclusively. Exclusivity means that the content offered to consumers is not perfectly substitutable [42]. In the latter case, since pay-TV involves the payment of a price, if consumers perceive the channels as perfectly substitutable, they will have no incentive to pay. This content is characterised by a high level of subscription, a mixed programming offer (sport and cinema), previously acquired from the initial rights holders. Considered as an essential factor in attracting customers, the acquisition of premium content is therefore the only way for pay-TV operators to capture interested segments of consumers and to recover the costs incurred in acquiring this content [33].

Empirical review

The literature on the subject is scarce. However, some recent or non-recent analyses, both descriptive and empirical, provide an idea of the determinants of the diversification of television access platforms. According to [11], the number of channels for receiving television from a television set increases with the number of people in a household, the level of household income and the age of the head of household. These analyses are in line with previous empirical work, which shows that household characteristics such as household size or the number of children [27], as well as the characteristics of the head of household, in particular age [30] and income [12], significantly influence the modes of access to television. Where innovators are young people with higher income levels compared to non-innovators [40].

In addition, the impact of the level of adoption of other technologies in a household is also relevant. More specifically, improved access to the Internet, the high level of ownership of mobile phones and computers promote multiple access to television [9]. This is what [50] seeks to demonstrate when he introduces the term "technophile" into his study to designate individuals who own several ICT equipment for access to information and communication services. The author starts from the principle that technophiles are more likely to be multi-equipped, even if it does not lead to the desired results. Studies have also taken into account the utilitarian aspect in content access behaviour, while starting from the principle that individuals are active consumers [1], who are motivated in the adoption of new technologies and services by the coverage of an important need [8]. When a consumer has an unmet need and a new service meets the need at an acceptable cost, the consumer adopts it [8]. The second motivator is the insatiable appetite for content or service.[8] Fans who can't get enough of certain content such as movies or soap operas are willing to pay just about any price for the latest technology. Often, consumers with an insatiable appetite add the new technology or service to the old rather than substitute the new for the old [8].

Technological innovation through the arrival of DTT and the spread of ADSL are relevant factors in this regard [11]. Thus, the characteristics of the innovation are the most important determinant because of its relative advantage over other platforms, which will encourage the emergence of real competition between platforms [31]. In this sense, new technologies can substantially affect the degree of substitution between content and, consequently, between platforms [35]. This differentiation of the offer gives an added value to the platform that must be perceptible to the viewer. Thus, individuals will adopt several platforms in order to benefit from significant network effects [13].

METHODS

Study data

To test the hypothesis, the study uses primary data from a household survey conducted during the month of April 2021 among 742 households in the cities of Yaoundé and Douala, which have the highest television penetration rates in Cameroon [34]. The objective of the survey is to understand the adoption, consumption and appreciation of television in Cameroon. Only households that are equipped with at least one

functional television set are surveyed, and for each household, the heads of household are surveyed because they are the ones who make the expenditure for the household. The sampling design applied for the household draw is of the two-stage stratified random type, the sampling stratum being the Survey Rounding. At the first level in each stratum, enumeration areas are drawn, and at the second stage, a sample of households is drawn from each zone according to each category of city.

Study variables

The dependent variables used in the study concern terrestrial television, cable and satellite. Each platform corresponds to a binary choice with the value 1 if the household decides to adopt it and 0 if not. 11.59% of the households in the study have chosen television via terrestrial waves, 51.62% have access to cable television and 52.43% to satellite television. A household has the opportunity to adopt more than one television platform. These four platforms can form a total of 23 combinations, or a maximum of 8 separate baskets, which can consist of only one platform, two or three of the four platforms, all four platforms simultaneously or none of them. The latter case, which constitutes the zero basket, i.e. the non-adoption of terrestrial television, cable and satellite, is not observed in the study because the sample is only made up of households that have access to television. This leads to the analysis considering a total of 23-1 combinations, i.e. 7 television access baskets, the description of which is presented in Table 1 below.

Table 1. Modes of access to television

Basket	Over-the-air television (O)	Cable (C)	Satellite (S)	Number of platforms	Percentage of households (%)
O	1	0	0	1	10,24
C	0	1	0	1	37,87
S	0	0	1	1	36,52
OC	1	1	0	2	0,27
OS	1	0	1	2	0,81
CS	0	1	1	2	14,02
OCS	1	1	1	3	0,27

The results indicate that all 7 possible configurations are observed. 84.63% of households have only one mode of television reception, of which 10.24% have only terrestrial reception, compared to 37.87% for cable and 36.52% for satellite. 15.37% of households have more than one mode of access to television, the most common combination being the combination of cable and satellite (14.02%).

The independent variables used in the study are the result of consumer choice theory and relate to income, preferences, access and usage rates, and the characteristics of the content offered:

– Income: According to theoretical predictions, consumption is an increasing function of income. As an individual's income increases, so does their consumption. Based on this premise, the expected results are that the higher the income level of the head of household, the higher the probability for that household to adopt cable and satellite together. Thus, income includes the categories of daily or weekly, monthly and annual income [46] compatible with the payment periodicities offered by broadcasters;
– Individual preferences: As preferences are heterogeneous, empirical studies introduce individual characteristics to

control for this heterogeneity. Two groups are retained: the characteristics of the household and the head of household [46]. The characteristics of the household concern: (1) The composition of the household, which takes the value 1 for households with children under 15 years of age and 0 for households without children under 15 years of age; (2) Household size measured as the number of household members; (3) The city of residence taking the value 1 for households located in the city of Yaoundé and 0 for households located in the city of Douala; (4) The number of television sets: This is defined as the number of television sets owned by the household. The characteristics of the head of household concern: (1) The sex, which takes the value 1 if it is male and 0 if it is female; (2) The level of education including the categories of primary, secondary and higher education; (3) The professional situation including the categories of employees, self-employed workers, students and retirees;
– Tariffs: The study distinguishes between tariffs related to access and use because access to the network must first be provided before the network can be used [44];
– The characteristics of the content offered: The study first retains the quality of the offer through: (1) The number of channels offered; (2) The number of news channels available; (3) The number of sports channels available; (4) The number of channels in HD format. Secondly, the diversity of the offer, defined as the number of genres offered by the broadcaster; Third, the cable television network, measured as the number of cable or satellite distribution points that exist in the household's area of residence.

METHODOLOGY

In the analysis of the determinants of multiple adoption, studies use univariate models such as the Poisson model for the number of SIMs [3, 36] or the Multinomial Logit for the different combinations used [19]. The main limitation of these univariate models is the exclusion in their modeling of the interdependence and simultaneity of adoption decisions [20]. Taking this limit into account makes it possible to introduce multivariate models, such as Multivariate Probit, which takes into account the simultaneity of choices. However, the Multivariate Probit only considers the probabilities of adoption of each platform and does not make a clear distinction between single and multiple adoption. This limitation leads to the use in the work of a second model, the ordered Probit, in which the defined dependent variable is the number of platforms adopted measuring the intensity or level of adoption [49, 45]. The study adopts this dual methodology.

Multivariate Probit

The proponents of consumer choice theory start from one main hypothesis: individuals are endowed with an optimising rationality, the decision criterion of which is calculation. The consumer's objective is to achieve the best possible situation, under the principle of maximizing utility and minimizing expenses. In the context of the study, the adoption of a platform b by household i represents a utility U and also involves a cost C which can be modelled as follows:

$$U_{ib} = X_{ib}^U \beta_U + \varepsilon_{ib}^U \tag{1}$$
$$C_{ib} = X_{ib}^C \beta_C + \varepsilon_{ib}^C \tag{2}$$

With : $i=1,\ldots,\ n$, the number of households. b the different platforms : ($b=O$ represents Over-the-air television, $b=C$ represents cable television and $b=S$ represents satellite television). X_{ib}^{U} and X_{ib}^{C} the vectors of demand characteristics (characteristics of the household and the head of household, number of television sets) and supply (tariffs, quality and diversity of supply, distribution network), β_U and β_C the vectors of the parameters to be estimated and ε_{ib}^{U} et ε_{ib}^{C} the assumed error terms distributed jointly according to a normal distribution.

Household i decide to adopt the platform b when the utility U that could be derived from it is greater than the cost C that could result, i.e. when the net utility y_{ib}^{*} which is the latent variable is positive. The decision to adopt a platform can be formally modelled b by the household i, noted y_{ib} as :

$$y_{ib} = \begin{cases} 1 \ si \ y_{ib}^{*} = \beta_0 + \sum_{i=1}^{742}\beta_{ib}\,Demand_{ib} + \sum_{i=1}^{742}\beta_{ib}\,Suply_{ib} + \varepsilon_{ib}, \ avec \ y_{ib}^{*} > 0 \\ 0 \ if \ no \end{cases} \quad (3)$$

With : $\varepsilon_{ib} = \begin{cases} \varepsilon_{iT} = \eta_i + \mu_{iO} \\ \varepsilon_{iC} = \eta_i + \mu_{iC} \\ \varepsilon_{iS} = \eta_i + \mu_{iS} \end{cases}$

where $\begin{pmatrix} \varepsilon_{iO} \\ \varepsilon_{iC} \\ \varepsilon_{iS} \end{pmatrix} \to var\ (0,\Sigma), with\ \Sigma = \begin{pmatrix} 1 & \rho_{OC} & \rho_{OS} \\ \rho_{CO} & 1 & \rho_{CS} \\ \rho_{SO} & \rho_{SC} & 1 \end{pmatrix}$

The errors of these three equations consist of a part η_i common to the four equations and a single part to each equation: (μ_{iO}, μ_{iC}), (μ_{iO}, μ_{iS}), (μ_{iC}, μ_{iS}), μ_{iO}, μ_{iC}, μ_{iS} are assumed to be zero-sum, independent of each other and independent of the explanatory variables of the model, whereas η_i is an unobserved variable that influencies the two dependent variables linearly. Since the three equations are dependent, we have a multivariate normal distribution that hides several simultaneous choices. The estimation of this model is done by the maximum likelihood method simulated according to the GHK (Geweke-Hajivassiliou-Keane) method implemented in the STATA software [7].

Ordered Probit

The purpose of using the ordered probit model is to examine the determinants of the adoption of a given mix of broadcasting technologies (number of platforms). The adoption decision is modeled in a framework of random utility. Under the assumption of a normal distribution of the error term, the variable "level of access to television" Y used by household i indicates whether the household adopts one platform ($Y_i = 1$), two platforms ($Y_i = 2$) or three platforms ($Y_i = 3$). It is assumed that the household decides to adopt a number of platforms based on maximizing an underlying utility function:

$$U_i = V_i(\beta'x_i) + \varepsilon_i, \qquad \varepsilon_i \to N(0,1) \qquad with\ i = 1,2,\ldots,742$$

Where V_i, the observed part of the household utility function is expressed as a function of a vector of exogenous variables related to the household and technology, xi, and a vector of parameters to be estimated, β, and is assumed to be equal to the mean of the random variable U_i. The unobserved portion of the utility framework is represented by a random error term ε_i with a zero mean. The household chooses to adopt an additional platform if the benefit obtained by adopting it is greater than the usefulness of not adopting it. The level of

utility of each household U_i is not observed and is represented by a latent variable y_i^{*} as :

$$Y_i = \begin{cases} 1 & si & y_i^{*} \le \alpha_1 \\ 2 & si & \alpha_1 < y_i^{*} \le \alpha_2 \\ 3 & si & y_i^{*} > \alpha_2 \end{cases} \qquad (5)$$

Where $\alpha_1 < \alpha_2$ are parameters of unknown thresholds to be estimated with β. Assuming that U_i follows a normal distribution, we obtain the following probabilities:

$$Prob(Y = 1|x) = Prob(Y^{*} \le \alpha_1|x) = Prob(x'\beta + \varepsilon \le \alpha_1|x) = \Phi(\alpha_1 - x'\beta)$$
$$Prob(Y = 2|x) = \Phi(\alpha_2 - x'\beta) - \Phi(\alpha_1 - x'\beta) \qquad (6)$$
$$Prob(Y = 3|x) = 1 - \Phi(\alpha_3 - x'\beta)$$

Where Φ (.) is the standard normal cumulative distribution function. Parameter vectors α and β are estimated by the maximum of plausibility. The purpose of the maximum likelihood estimator is to choose the vector of the α parameters that maximizes the likelihood function, i.e., for which the observed data are most likely. To keep things simple, the log likelihood feature is usually used. Therefore, depending on the different thresholds α_k ($i = 1,\ 2,3$), the log-likelihood of the sample is defined by the function:

$$\log L(y,\alpha_k,\beta) = \sum_{i=1}^{N}\left\{ y_{i1}log\left[\Phi\left(\frac{\alpha_1}{\sigma} - \frac{\beta}{\sigma}X_i\right)\right] + y_{i2}log\left[\Phi\left(\frac{\alpha_2}{\sigma} - \frac{\beta}{\sigma}X_i\right) - \Phi\left(\frac{\alpha_1}{\sigma} - \frac{\beta}{\sigma}X_i\right)\right] + y_{i3}\left[1 - \Phi\left(\frac{3}{\sigma} - \frac{\beta}{\sigma}X_i\right)\right]\right\} \qquad (7)$$

RESULTS AND DISCUSSIONS

Conditional and unconditional adoption

The analysis of the interactions between the different television platforms is analyzed through the marginal, joint and conditional probabilities presented in Table 2. Marginal probability statistics show that overall, there is a large disparity between male-headed and female-headed households in terms of access to television. Cable and satellite televisions are the most adopted by households. Cable TV is adopted alone by 52.2% of households, in combination with over-the-air television by 0.7% of households and in combination with satellite television by 14.9% of households. Satellite TV is adopted alone by 51.4% of households, in combination with terrestrial television by 1.2% of households. Conditional probability statistics highlight the interdependence that exists between the different platforms for accessing television. When households already have access to a platform such as over-the-air or cable, the probability of adopting satellite TV as well is 10.8% and 52.2% respectively. In addition, the probability of adopting cable TV is high when a household has access to another platform, such as over-the-air (46.0%) or satellite (11.0%). This suggests two results: (1) Households with access to over-the-air television are more likely to diversify their access by including cable television; (2) Cable adoption becomes less necessary for households that already have access to satellite television.

Multivariate Probit Results

Table 3 presents the econometric results from the estimation of the Multivariate Probit model. Overall, the model is well specified. The Wald test validates to 1% the hypothesis that the coefficients of the regressions of each equation are jointly nonzero.

Table 2: Probabilities of conditional and unconditional adoption

	Male	Female	Total population
Marginal probabilities			
(O=1)	0.1137(0.2917)	0.1262(0.3285)	0.1171(0.3056)
(C=1)	0.5356(0.4889)	0.4903(0.4896)	0.5227(0.4891)
(S=1)	0.5223(0.4670)	0.4967(0.4796)	0.5149(0.4704)
Joint probabilities			
(O=1,C=1)	0.0095(0.0447)	0.0022(0.0091)	0.0074(0.0383)
(O=1,S=1)	0.0126(0.0537)	0.0043(0.0319)	0.0102(0.0486)
(C=1,S=1)	0.1650(0.3290)	0.1115(0.2710)	0.1496(0.3142)
(O=1,C=0,S=0)	0.0940(0.2887)	0.1196(0.3218)	0.1014(0.2987)
(O=0,C=1,S=0)	0.3652(0.4534)	0.3809(0.4679)	0.3698(0.4574)
(O=0,C=0,S=1)	0.3466(0.4544)	0.3784(0.4701)	0.3558(0.4589)
(O=0.C=1.S=1)	0.1635(0.3281)	0.1091(0.2667)	0.1477(0.3123)
(O=1,C=0,S=1)	0.0096(0.0538)	0.0055(0.0561)	0.0084(0.0545)
(O=1,C=1,S=0)	0.0059(0.0358)	0.0018(0.0127)	0.0047(0.0310)
(O=1,C=1,S=1)	0.0042(0.0402)	0.0003(0.0021)	0.003(0.0339)
Conditional probabilities			
(O=1/C=1)	0.1016(0.2867)	0.1306(0.3733)	0.1100(0.3143)
(O=1/S=1)	0.0803(0.3500)	0.1769(0.800)	0.1083(0.7531)
(C=1/O=1)	0.4799(0.4972)	0.4082(0.4908)	0.4602(0.4961)
(C=1/S=1)	0.5373(0.5027)	0.4860(0.4899)	0.5224(0.4992)
(S=1/O=1)	0.3530(0.4281)	0.3189(0.4167)	0.3437(0.4249)
(S=1/C=1)	0.1016(0.2867)	0.1306(0.3733)	0.1100(0.3143)
(O=1/C=1,S=1)	0.0141(0.0799)	0.0010(0.0084)	0.0103(0.0679)
(C=1/O=1,S=1)	0.3711(0.1654)	0.1547(0.1044)	0.3122(0.1515)
(S=1/O=1,C=1)	0.6314(0.4299)	0.5710(0.4448)	0.6167(0.4340)

Notes : Standard deviation are in brackets.

Table 3.Multivariate Probit regression results

	Over-the-air television	Cable	Satellite
Income(daily/weekly income)			
Monthly income	-0.199(-0.790)	0.227(1.850)	0.130**(1.030)
Annual income	-0.551(-0.800)	0.502(1.960)	0.450**(1.400)
Residence city (Yaounde)	-0.995***(-5.930)	0.420***(3.840)	0.193*(1.800)
Household size	0.005(0.038)	0.014(0.023)	0.026(1.170)
Household with children under15years	-0.149(-0.184)	-0.047(-0.132)	-0.167(-1.310)
Sex(Male)	-0.046(-0.163)	0.171(1.560)	-0.020(-0.109)
Education	-0.051(-0.479)	-0.904***(-2.350)	1.216***(3.300)
Profession	0.363**(0.181)	0.482(0.358)	0.194***(0.139)
Number of television sets	0.661(5.850)	0.113(1.130)	-0.335(-3.960)
Audio visual licence fee	-0.010(0.000)	0.006(0.000)	-0.006(-0.009)
Cable access tariff	-0.020***(-0.000)	0.018**(0.000)	-0.030**(-0.000)
Cable usage tariff	-0.017*(-0.000)	-0.006***(-0.002)	0.009***(0.002)
Satellite access tariff	-0.039**(-0.000)	0.007***(0.152)	-0.003***(-0.001)
Satellite usage tariff	-0.001***(-0.000)	0.006**(0.088)	-0.001(0.003)
Number of sports channels available	-0.043(-0.083)	-0.206***(-9.620)	0.064***(7.200)
Number of news channels available	-0.163***(-3.546)	-0.211***(-10.530)	0.123***(5.240)
Number of cinema channels available	-0.199***(-4.280)	0.038(2.813)	0.017***(1.390)
Number of channels available	-0.017(-0.500)	0.029***(2.620)	-0.120***(3.180)
Number of channels in HD format	-0.014**(-1.300)	0.005(-2.730)	0.016***(3.180)
Number of genres available	-0.390***(-8.490)	0.016***(4.730)	0.119***(3.180)
Number of distribution points	----------------	0.087(2.680)	0.271***(5.190)
Constant	-0.481(-0.741)	-0.109(-0.185)	-3.529***(-0.262)
ρ_{CH}	-0.517(-0.330)		
ρ_{SH}	0.187(-0.223)		
ρ_{SC}	-0.720***(0.184)		
Observations	=742		
Waldchi2(108)	=222.09		
Log likelihood	=-123.56773		
Prob>chi2	=0.0000		

Notes : t-Student are in brackets. ; Significantly different from 0 at the 1%(***). 5%(**) and 10%(*) thresholds.

The likelihood ratio test carried out after the model estimation rejects the assumption of platform independence at the 1% threshold. In other words, it makes it possible to reject the hypothesis of exogeneity between terrestrial television, conventional and premium cable and satellite, which further reinforces the choice of Multivariate Probit, rather than the use of four independent simple Probits. Furthermore, the results in the table indicate that there is a positive and non-significant correlation between satellite and over-the-air television, a negative and non-significant correlation between cable and over-the-air television, and a negative and significant correlation at the 1% threshold between cable and satellite.

Table 3 also presents the determinants of the adoption of airwaves, cable and satellite. The results show differentiated effects of demand characteristics on platform adoption. Regarding household characteristics, only the city of residence plays a relevant role in the adoption of a platform. Thus, the probabilities of adopting conventional cable and satellite are higher for households located in the city of Yaoundé. Analysis of the characteristics of the head of household shows that as the level of education of the head of household increases, the greater the probability of this household adopting the satellite, indicating their ability to understand and take ownership of this complex technology more through greater knowledge.

Table 4. Ordered Probit regression of TV access level

	Coefficients (t-Student)	Marginal effects		
		Prob(Y=1|X)	Prob(Y=2|X)	Prob(Y=3|X)
Income(daily/weekly income)				
Monthly income	0.461**(2.22)	-0.073***(-2.49)	0.070***(2.44)	0.003**(1.83)
Annual income	0.729***(4.36)	-0.261***(-3.85)	0.243***(3.85)	0.018*(1.67)
Residence city (Yaounde)	0.174(0.08)	-0.016(-0.55)	0.016(0.55)	0.001(0.56)
Household size	0.038**(2.01)	-0.009**(-1.85)	0.008**(1.85)	0.001(1.27)
Household with children under15years	-0.249(-1.41)	0.045(1.16)	-0.043(-1.16)	-0.002(-1.02)
Sex(Male)	0.205(1.22)	-0.031(-0.94)	0.030(0.94)	0.002(0.82)
Education	-0.135*(-1.68)	0.030*(-0.28)	-0.029(0.28)	-0.001(0.29)
Profession	0.477(0.43)	-0.054(1.30)	0.053(-1.30)	0.002(-1.13)
Number of television sets	0.077(1.40)	-0.026(-1.29)	0.024(1.30)	0.001(0.99)
Audio visual licence fee	-0.019(-1.08)	0.019*(1.08)	-0.013*(-1.08)	-0.011(-0.99)
Cable access tariff	0.017(1.46)	-0.011*(-1.49)	0.012*(1.49)	0.015(1.15)
Cable usage tariff	0.045***(2.18)	-0.003***(-2.18)	0.005**(2.15)	0.003(1.59)
Satellite access tariff	-0.017***(-2.91)	0.019**(2.85)	-0.012**(-2.86)	-0.014(-1.54)
Satellite usage tariff	-0.005*(-3.89)	0.003***(3.98)	-0.006***(-3.96)	-0.005(-1.73)
Number of sports channels available	-0.064***(-1.27)	0.025(1.28)	-0.024***(-1.28)	-0.001*(-1.67)
Number of news channels available	0.162***(3.75)	-0.019***(-3.79)	0.018***(3.86)	0.001(1.58)
Number of cinema channels available	-0.088**(-2.10)	0.016**(2.11)	-0.015**(-2.11)	-0.001(-1.39)
Number of channels available	-0.006(-1.62)	0.011(1.64)	-0.011(-1.65)	-0.011(-1.24)
Number of channels in HD format	0.002(0.06)	-0.007(0.64)	0.006(0.64)	0.003(0.60)
Number of genres available	0.021(0.45)	-0.014(-0.45)	0.014(0.45)	0.011(0.45)
Number of distribution points	0.095***(2.37)	-0.018**(-2.37)	0.018**(2.38)	0.042(1.44)
Thresholds				
α_1	6.376(1.126)			
α_2	8.885(1.345)			
Observations	=742			
Waldchi2(22)	=114.85			
Prob>chi2	=0.0000			
PseudoR2	=0.2581			

Notes : t-Student are in brackets. ; Significantly different from 0 at the 1%(***). 5%(**) and 10%(*) thresholds.

The socio-professional category is the most relevant determinant. The likelihood of adopting over-the-air and cable television increases when the head of household is self-employed. Similarly, the probability of adopting terrestrial television increases only in a relevant way when the head of household is a pupil or student. This demonstrates the relevance of the level of income on the probability of adopting a platform. Similarly, the revenue level results on the probability of adopting a platform indicate that an increase in the revenue level does not significantly increase the probability of adopting conventional cable and significantly increases the probability of adopting satellite, due to higher satellite rates compared to cable. The results also show differentiated effects of the characteristics of the offer on the adoption of a platform. This indicates that terrestrial television, often perceived as a free or low-cost option, is less sensitive to variations in access and usage rates on other platforms. Due to its generally free or inexpensive nature, changes in pricing do not significantly affect consumers' decision to adopt this technology. For cable and satellite services, high cable access rates increase the likelihood of adopting cable while decreasing the likelihood of satellite adoption, indicating that demand for cable is less sensitive to changes in access rates. Conversely, the high rates for the use of cable reduce the probability of adopting cable and increase that of satellite. Similarly, high satellite access and usage rates increase the likelihood of adopting cable and reduce the likelihood of satellite adoption. This reveals that cable and satellite are perceived as being substitutable in the eyes of consumers. In terms of the quality of the offer, the results show that a high number of available channels, sports, news, cinema and HD channels increases the likelihood of adopting satellite TV. The likelihood of adopting cable increases only when there is an increase in the number of movie channels. In addition, the diversity of the offer or the high number of genres offered increases the likelihood of adopting cable and satellite television.

This result is higher for satellite. These results may indicate that in the eyes of the consumer, satellite has the advantage of providing a more diversified offer, thus giving each individual in the household the opportunity to have access to channel varieties that correspond to his or her preferences. In addition, the more cable and satellite TV broadcasters in an area, the more likely they are to be adopted. Indeed, a large distribution network translates into better geographical availability and better visibility on the market, which promotes the memorization and purchase of the product.

Ordered Probit results

The Probit Ordered model aims to highlight the determinants of the level of access to television. The results of the ordered Probit model in Table 4 show that the chi2 (Wald chi2(22)= 114.85 ; Prob > chi2=0.0000) is statistically significant at 1%, indicating that the joint test that all coefficients are equal to 0 is rejected. The results show that demand and supply characteristics influence the number of TV platforms used by households. Regarding the characteristics of demand, the results show that among the characteristics of the household, only the size of the household significantly increases the level of access to television: the more the size of the household increases, the more the number of television platforms adopted by this household increases by 3.8%. In addition, the frequency of income collection is a determining factor in the level of access to television. As the monthly or annual income of the head of household increases, the greater the likelihood of adopting more than one platform, which may be due to the ability of these households to make their payments on time more than daily or weekly income. Regarding the characteristics of the offer, the results of the tariffs show that only cable tariffs increase the level of access to television. An increase in cable usage rates increases the likelihood of adopting more than one platform by 1%, indicating that the use

of traditional cable favors the use of an additional platform with more attractive content. The high number of cable points in the area of residence increases the likelihood of adopting more than one television broadcasting technology, highlighting the importance of the distribution network and the accessibility of cable television points in adoption behaviours.

DISCUSSION

The results are interpreted in accordance with the objectives of the study. First, 15.37% of households own more than one mode of access to television and all possible combinations of television platforms are observed: over-the-air television and cable, over-the-air television and satellite, cable and satellite and all three platforms simultaneously. Of the 15.37% of households diversifying their TV access, more than half (91.22%) combine cable and satellite, which is therefore the most prevalent combination. Secondly, there is a relevant surrogate relationship between cable and satellite. This substitution relationship could mean that through the adoption of both platforms, households follow a logic of strategic diversification. Indeed, some households will combine platforms to maximize access to content, but this does not necessarily mean that they will consume as much content from each platform. This means that households can choose to adopt either platform based on their immediate needs or priorities, but it's rare for them to leverage both to the fullest simultaneously. One of the platforms can be used as a secondary or fallback option, rather than as a primary service, reducing its usage. This confirms the hypothesis of the study. Thirdly, households will adapt to their preferences and budget constraints through this choice. In terms of preferences, the positive effect of the diversity of genres offered is that households will adopt more than one television platform in order to cover their viewing needs and benefit from the intrinsic value of adopting an additional platform [25].

However, the non-significant effect is that when a platform already offers a diversified offer, the addition of a platform is not done systematically. Households will just use an additional platform on an exceptional basis to access exclusive content not available on the other platform. The size of the household is important in this sense. A greater diversity of content offered to better satisfy the varied preferences of household members. Regarding budget constraints, the results show that the frequency of income collection is a determining factor in the level of access to television. For households with a monthly or annual income frequency, the likelihood of adopting more than one platform increases more as income increases. This result may be due to the more regular or stable nature of monthly and annual incomes, which makes it possible for these households to make their payments on time more than daily/weekly income. Similarly, an increase in cable usage rates increases the likelihood of adopting more than one platform. This result can be explained by the fact that because cable TV is more accessible, households have the opportunity to adopt more than one platform as an alternative strategy. This strategy allows them to balance their needs for television content while minimizing costs. The network effect is also important. The high number of cable television points in the area of residence increases the likelihood of adopting more than one television broadcasting technology. Thus, the presence of a dense network of cable television points makes services more accessible and attractive to households, which are then more inclined to subscribe to several subscriptions. This result

highlights the importance of the distribution network and accessibility on adoption behaviours, highlighting the importance of the distribution network and the accessibility of cable television points in adoption behaviours. Regarding the first aspect, since subscription is the availability of distribution networks, implicitly, households that are more exposed to them are more inclined to have two subscriptions compared to those that are exposed to a single network. As such, the more distribution outlets there are, the more competitive options users have access to, which can incentivize them to adopt multiple subscriptions to maximize the value of their viewing experience.

Conclusion

The objective of this article is to analyze the determinants of multi-access to television and is based on the theory of consumer choice by questioning the determinants of this mode of access to television. To achieve this, it uses Multivariate Probit to be taken into account in analyses of combined or multiple adoption cases and Ordered Probit, in order to understand TV access levels. The results reveal that there are substitution relationships between the various platforms associated by the household, which indicates that households are in a logic of strategic diversification and adapt their choices according to their preferences and budget constraints. The fact that consumers perceive cable and satellite as substitutes but adopt them jointly gives some implications for operators and the government. Operators must multiply strategies aimed at promoting viewer loyalty, for example through the optimisation of the elements of the offer that promote joint adoption. In addition, the government must take measures to reduce the heterogeneity of content offered between television platforms, so as to encourage households to focus only on the platform that best corresponds to their preferences and income. The government can also encourage operators to set up digital platforms detailing the proposed offer, with a view to facilitating access to information. The present study has some limitations. It would be interesting for future studies to include other television access platforms such as DTT and ADSL. Subsequently, several other variables can be taken into account, such as the level of information that the household has on the offers offered by broadcasters or the time available for viewing, which constitute the variables retained in the modern approach to consumer choice theory. Also to make a comparison between the rational and irrational choice models, in order to identify which one explains the phenomenon of diversification of access to television.

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REFERENCES

1. Althaus, SL. et Tewksbury, D., « Patterns of Internet and Traditional News Media Use in a Networked Community », *Political Communication*, 17, 21-45, 2000.
2. Annafari MT., « Multiple Subscriptions of mobile telephony: explaining the diffusion pattern using sampling data », *Telecommunications policy*, 37(10), 930-939, 2013.
3. Annafari, MT. et Bohlin, E., « Empirical exploration of factors that determine multiple mobile phone subscriptions », *International Journal of Mobile Communications*, 12(1), 12-28, 2014.

4. Autorité de Régulation de la Communication Audiovisuelle et Numérique,*Observatoire de l'équipement audiovisuel des foyers en France hexagonale: Résultats du 2nd semestre 2023 pour la télévision et la radio*, 2023.

5. Ariansyah, K., et Yuniarti, D., « Understanding the adoption of digital terrestrial, cable-based, and satellite-based television to speed up the analogue switch-off in Indonesia », *Telematics and Informatics*, 62, 101633, 2021.

6. Arrow, KJ., *Social choice and individual values*, Yale university press, 1951.

7. Cappellari, L., et Jenkins PS., « Multivariate Probit Regression Using Simulated Maximum Likelihood »,*The Stata Journal: Promoting Communications on Statistics and Stata*, 3(3), 278–294, 2003.

8. Carey, J., « Consumer adoption of new communication technologies ». *IEEE Communications Magazine*, 27(8), 28-32, 1989.

9. Centre de recherche pour l'Etude et l'Observation des Conditions de vie (CREDOC), *La diffusion des Technologies de l'Information et de la Communication dans la société Française*, 2007.

10. CREDOC., *La diffusion des Technologies de l'Information et de la Communication dans la société Française*, 2013.

11. CREDOC., La diffusion des Technologies de l'Information et de la Communication dans la société Française, 2014.

12. Chan-Olmsted, SM., Li, JCC.et Jung, J., « The profiling of cable modem broadband consumers: Characteristics, perceptions and satisfaction ». *Journal of Targeting, Measurement and Analysis for Marketing*, 13(4), 327–345, 2005.

13. Choi JP., Tying in two-sided markets with multi-homing, Dans la *conférence régionale du CESIFO sur la microéconomie appliquée*, 2007.

14. Décret No. 2000/158 du 03 avril 2000 fixant les conditions et les modalités de création et d'exploitation des entreprises privées de communication audiovisuelle.

15. DellaVigna, S., « Psychology and Economics: Evidence from the Field », *Journal of Economic Literature*, 47, 315–372, 2009.

16. Deloitte, *Digital Media Trends Survey*, 2020.

17. Bisong ED., Lyonga NK., Mokondo MS., Nseme NS. et Yenshu VE., « Determinants of local and foreign TV channels viewership amongst TV audience in the Buea municipality- South West Region, Cameroon »,*Current Trends in Mass Communication*, 1(1), 1-11, 2022.

18. Enquête Camerounaise Auprès des Ménages, Troisième Enquête, Institut National de la Statistique, 2007.

19. Gong S., Bergtold SJ.et Yeager E., « Assessing the joint adoption and complementarity between in-field conservation practices of Kansas farmers », *Agricultural and Food Economics*, 9(30), 2021.

20. Greene, WH., *Econometric Analysis*, Prentice Hall, New Jersey, 2008.

21. Grubb MD., « Behavioral consumers in industrial organization: an overview », *American Economic Review*, 99(5), 1770-1807, 2015.

22. Gu, R., Oh, LB.et Wang, K., « Multi-homing on SNSs: the role of optimum stimulation level and perceived complementarity in need gratification »,*Information & Management*, 53(6), 752-766, 2016.

23. Hu, Y., Zhao, L., Zou, D., et Teng, M., "Why Consumers Need Diversity? Understanding Consumers' Multiple Usage of Competing Mobile Applications from a Variety-seeking Perspective", dans*Pacific Asia Conference on Information Systems 2017 Proceedings*, 167-174.

24. Hwang W. et Oh J., « Adoption of new online services in the presence of network externalities and complementarities », *Electronic Commerce Research and Applications*, 8(1), 3-15, 2009.

25. Ishihara, A., et Oki, R., Asymmetric Product Line and Multi-Homing, 2021.

26. Jevons, W. S., *The Theory of Political Economy*, Macmillan, Londres, 1871.

27. Kang, MH., « Digital cable: exploring factors associated with early adoption », *Journal of Media Economics*, 15(3), 193–207, 2002.

28. Katz E., Blumler J. G. et Gurevitch M. « Utilization of mass communication by the individual ». In: Blumler J. G. et Katz E. (eds) *The Uses of Mass Communications: Current Perspectives on Gratifications Research. Beverly Hills*, CA: SAGE, 19–32, 1974.

29. Katz, M.L. et Shapiro, C., « Technology Adoption in the Presence of Network Externalities »,*Journal of Political Economy*, 94(4), 822-841, 1986.

30. Kim, SJ., Chan-Olmsted, SM., Hwang KH. et Chang, BH., « Examining the Use, Perception, and Motivation of Cord-Cutting: A Consumer Segment Approach »,*Journalism & Mass Communication Quarterly*, 98(1), 126-147, 2021.

31. Li, SCS., « Exploring the factors influencing the adoption of interactive cable television services in Taiwan »,*Journal of Broadcasting and Electronic Media*, 48(3), 466–483, 2004.

32. Li, SCS.,« Digital television adoption: « Comparing the adoption of digital terrestrial television with the adoption of digital cable in Taiwan »,*Telematics and Informatics*, 31, 126-136, 2014.

33. Matteucci N., Nicita A. et Ramello GB., « Concurrence dans le marché de la télévision payante en Europe à l'ère de la convergence », *Réseaux*, 5(139), 19-47, 2006.

34. Ministère des Postes et Télécommunications et Institut National des Statistiques, *Annuaire Statistique des Télécommunications et TIC au Cameroun*, 2017.

35. Motta, M. et Polo, M., « Concentration and Public Policies in the Broadcasting Industry: the Future of Television »,*Economic Policy*, 12(25), 293-334, 1997.

36. Mvele SH., Ango ML. et Ekome EGC., « Multiple subscriptions to mobile networks and consumer satisfaction », *Journal of Retailing and Consumer Services*, 47, 375-381, 2019.

37. Observatoire Européen de l'Audiovisuel,*Year book 2019/2020: Key trends*, 2019.

38. Pareto, V., *Manual of Political Economy : a critical and variorum edition*, Montesano A., Zanni A., Brunni L., Chipman, J.S. et McLure M., Edition, Oxford University Press, 2014. (Original work published 1906).

39. Phalen PF. et Ducey RV.,« Audience behavior in the multi-screen "video-verse" »,*International Journal on Media Management*, 14 (2), 141–156, 2012.

40. Rogers, EM.,*Diffusion of Innovations*, Free Press, New York, 2003.

41. Rubin A. M. « The uses-and-gratifications perspective of media effects ». In J. Bryant et D. Zillmann (Eds), *Media Effects: Advances in Theory and Research*, Lawrence Erlbaum Associates, 525–548, 2002.

42. Sonnac, N. « Concurrence et structure de marché : les modèles d'affaires de la télévision d'aujourd'hui ». Dans J.C. Parracuelos et P.J. Benghozi (Eds), *Télévision, l'ère du numérique*, La documentation Française, 161-184, 2011.

43. Sun, Y., Ni, L., et Wang, N., Understanding Users' Multi-Homing Intention on Peer-to-Peer Accommodation

Platforms", dans*Proceedings of the 18th International Conference on Electronic Business*, 709-720.

44. Taylor, LD., *Telecommunications demand in theory and practice*, Kluwer Academic Publishers, 1994.
45. Teklewold H., Kassie M. et Shiferaw B., « Adoption of Multiple Sustainable Agricultural Practices in Rural Ethiopia »,*Journal of Agricultural Economics*, 64(3), 597–623, 2013.
46. Union Internationale des Télécommunications (UIT), *Manuel pour mesurer l'accès des ménages et des particuliers aux TIC et l'utilisation de ces technologies*, 2020.
47. Walras L.,*Eléments d'économie politique pure*, Corbas, 1874.

48. Wise, AS.et Duwadi, K., « Competition between cable television and direct broadcast satellite: the importance of switching costs and regional sports networks »,*Journal of Competition Law and Economics*, 1(4), 679-705, 2005.
49. Wollni, M., Lee, DR. et Janice, LT., « Conservation agriculture, organic marketing, and collective action in the Honduran hillsides »,*Agricultural Economics*, 41, 373–384, 2010.
50. Yebe ZG., « Profils des utilisateurs, adoption et appropriation de la téléphonie mobile au gabon : une étude économétrique sur données de Libreville et de Port-Gentil »,*L'Harmattan*, 2(14), 167–193, 2011.
51. Yersel, B., « Adoption factors to digital TV platforms in Turkey »,*Journal of Human Sciences*, 16(2), 469-476, 2019.

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