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USE OF INFORMAL MOBILE TELEPHONY IN LOW INCOME HOUSEHOLDS IN COLOMBIA

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Abstract.
Access to mobile telephony in Colombia exhibits rather interesting features compared to other countries. Colombia witnessed the beginning of a new alternative for communication consisting in the use of informal resale of minutes on the streets and small stores during the first years of this century. In this paper we are interested in analyzing the main factors that determine the utilization of this kind of service. We use a probabilistic model to explain the characteristics of the people that use 'informal resale' on the streets and we find that people in the modality of prepayment and people from small cities has a higher probability of using this alternative. It is also found that people in the firm-leader use more often this service. These results seem indicate that price differentials among on-net and off-net and between prepaid and postpaid are the causes of the rise of this economic activity.

Resumen
El acceso a la telefonía móvil en Colombia evidencia ciertas particularidades con respecto a otros países. En Colombia surgió una nueva alternativa de comunicación que consistía en la venta de minutos de celular en las calles y en pequeños negocios durante los primeros años de ésta década. En este documento se analizan las principales características de quienes usan esta modalidad de comunicación con base en una encuesta dirigida a usuarios y no usuarios de bajos ingresos. Se usa un modelo probabilístico para explicar las características de las personas que lo usan y se encuentra que las personas que están en la modalidad de contrato prepago y que viven en ciudades pequeñas tienen una mayor probabilidad de usar esta alternativa de comunicación. De otro lado se encuentra que quienes están con el operador dominante tienden a usar este servicio también de una forma más notoria. Estos resultados parecen indicar que los diferenciales de precios entre las llamadas off-net y on-net así como entre prepago y postpago son los que alimentaron el surgimiento de esta actividad

JEL classification: O30; O10; P59; L86; C24; O52

Keywords: Mobile telephony, ICT, gender gap, Resale

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1. Introduction

Diffusion of mobile telephony has been extensively studied in the literature. There are many works on convergence across countries and their effect on other markets. However, there are not enough research for Latin American countries and their particularities. Mobile telephony usage in Colombia exhibits rather interesting features compared to other countries. In recent years, due to the necessity condition of mobile even among low income people, and the high unemployment rate, in Colombia, an informal market of resale of mobile communications unfolded on the streets and micro-stores. As a result, the number of mobile users has grown faster than the last decade. However, not all the users own the mobile phone and it is the main focus of this work because, although in developing countries the diffusion has been slower than in the OECD countries, Colombia has one of the highest penetration rates in the region.

In this document we want to study what the main features of the people who use the 'informal resale of minutes' are in Colombia as a strategy for minimizing their spending in communications. For this purpose, we use a special survey made to 800 low-income people in four Colombian cities that was sponsored by IDRC and DIRSI and carried out during May and June 2007 in Colombia. The document is divided as follows: In the second section we show some theoretical background about mobile patterns and strategies of use in other countries. The third section summarizes the mobile market in Colombia during the past ten years. Then, we show the data base and explain our methodology. We use a Logit model to measure the probability of using the informal resale of minutes. It is important to note that our survey *only* let us to study the patterns of 'informal use' among people who owned a phone and in consequence, we made two estimations: one only with owners and the other with all the users.

2. Related Literature

In terms of mobile telephony there are two branches of analysis. On one hand, we can find studies on the diffusion of mobile as Botehlo and Pinto (2004), Carvalho (2006), Michalakelis et al (2008) and Massini (2004), among others. Botehlo and Pinto (2004) study the mobile growth rate for the case of Portugal by using three functional forms: Logistic, exponential and

Gompertz function. They found strong support for the presence of an S-curve in the adoption of cellular phones between 1996 and 2000. From the above functions, the logistic model is better for describing mobile diffusion. Carvalho (2006) shows that the introduction of prepaid cards explains most of the changes in the diffusion curve and the subsequent increase in penetration rate. She also argues that pre-paid services had an enormous impact on the rate of adoption of mobile phones in many countries and it is the major take-off determinant of mobile phone diffusion in Portugal. Michalakelis et al (2008) replicate the Botehlo and Pinto work for the case of Greece and found that price reduction in the last years was a very important factor. In these studies, they only include the rate of diffusion and analyze it isolated but they do not include financial restrictions by users as a variable that explain the rate of mobile diffusion. It is widely accepted that pre-paid cards were very successful in most countries where it was introduced and contributed to the democratization in the use of mobile phones worldwide. Massini (2004) used an epidemic model that let her to distinguish between the short and long run technological and economic factors as explanations of an evolving pattern of usage. Other studies as Gruber and Verboven (2001), Gruber (2001) and Hodge (2005) examine the patterns of diffusion in isolate cases.

One the other hand, we find studies on the patterns of use of this technology among the different groups of the population. In this last line of research, there are few studies on the patterns of use and access from the bottom of the population distribution and their backwardness with respect to high income people. There are many strategies used by the consumers in order to minimize their spending and the case of telecommunications illustrates it Among other strategies are the 'beeping' which involves calling a number and hanging up before the mobile's owner to whom is directed the call answers; and the use of SMS, or sending short messages that are less expensive. Zainudeen, et al. (2006) sort these type of strategies as short run strategies since people use them daily. Furthermore, it is argued that the use of beeping and SMS are more frequent when people who call do not need to get an answer. Zainudeen, et al. (2006) also highlight the importance of differencing when people have the choice of using or not their own phone, from people that do not have any other choice. In this last situation, the user does not have a 'strategy' but a default outcome

Even thought it seems surprising, demand for telecom services in most developing countries has been shown to be very important for low-income earners (See GSM Latin America 2006, and Gutiérrez and Gamboa 2007). Some authors estimate the proportion of

mobile communications expenses to be about 10 percent of their income. (See Intelecon, 2005; Gillwald, 2005; Souter et al., 2005)

Although not all the users owns a phone, Souter et al. (2005) have pointed out that telephone ownership is rapidly growing in developing countries and those who do not have a phone have said they 'wanted to acquire one within the next year'. In the case of fixed phone, many people still have not access because of credit constrains and availability of networks.

One important determinant of the pattern of consumption among people from low income ranges is the volatility of their income which limit their capability of being more rationale in acquiring products with the lower price per unit. As a consequence, mobile users try to employ different strategies in order to minimize their spending or to establish communications at no cost. Some examples are reported by Chakraborty (2004) and Donner (2005) for African countries. In these cases the use of beeping and 'missed calls' is very common with pre-established codes among the population.

De Angoitia y Ramirez (2008) show that for the Mexican case, low income people do not use SMS and prefer also to have the phone only for receiving calls such as in the case of other regions (Africa and Asia). Donner (2006) identifies the "rules of beeping" and assesses its significance using a variety of frames, including linguistics, structuration and communication technology and economic development. The paper contrasts beeping with SMS/text messaging based in personal interviews. From the supply side, many firms have experienced decreases in their average revenue per user (ARPU).

As we can see, the use of strategies to minimize mobile spending among low-income people goes beyond economic factors. In some cases, the capability of using the technology could be a serious barrier for users because of the low levels of education in Latin American countries.

3. Mobile market in Colombia

The beginning of the mobile telephony in Colombia was in 1994 and it was characterized by being only provided for two firms with regional licenses in the modality of post-payment. In the last three decades poor labor and education conditions have led low-income people to work without formal contracts in what is known as the informal sector. These people have few possibilities of get access to mobile phones, in particular under the post-paid mode, because of

the credit constrains that most of the low income people had and the low interest and expectations (it lagged the expectative) of the operating companies. The introduction of pre-paid options in 1997 stepped up the number of users. Nevertheless, as Gutierrez and Gamboa (2007) show, users in this last modality made much less calls than people in the post-paid contracts. Two factors that explain this pattern was first, the enormous price differentials and second, the 'calling party pays' system. As it can be seen from the figure 1, the number of mobile users raise faster after 1997.

At the end of 2003, a third operator entered the market. This fact generated a strong market competition which led to a reduction in prices and a consequently increase in the number of users to unexpected levels. That figure lets us to analyze the Herfindhal Hirshman index HHI for the entire period. When we take into account both the increase in competition as well as the reduction in price levels, we can argue that most of the growth was possibly due to the users in the modality of pre-payment. Competition and the increase in users with short level of utilization for making calls seem to impact negatively the average revenue per user (ARPU).

Although there is not a specific date, people started to make mobile call by means of the use of an 'informal service' of re-sale calls on the streets between 2002 and 2003. Despite of the availability of pre-paid card options, some factors like the considerable price differentials between fixed and mobile tariffs, the high per-minute tariff of the prepaid cards, and the price differentials between on net and off-net network tariffs were the most important one that encouraged this new market. This type of businesses grew at high rates in all Colombian cities since they offered prices very close to per-minute prices that could be obtained through a postpaid contract, so mobile users learnt that they could save some money with respect to their expenditure in the case of pre-paid. It is important to note, that the re-sale of minutes was and is also a source of income for those people who offer the resale communication services.

Figure 1.

| Mobile concentration (HHI) | Mobile Penetration |

| GPD (quarterly growth) | ARPU and Mobile Growth |
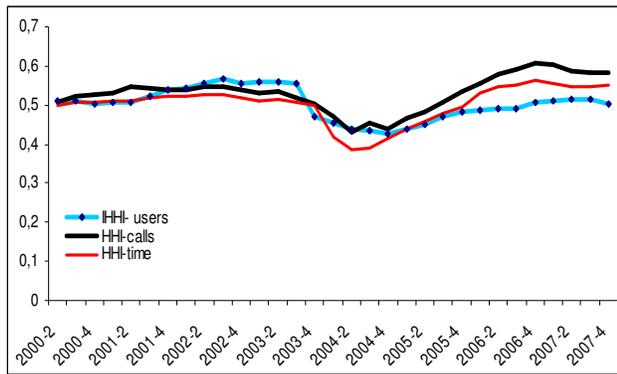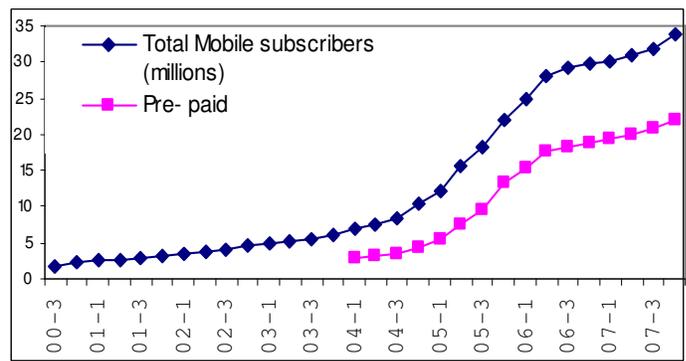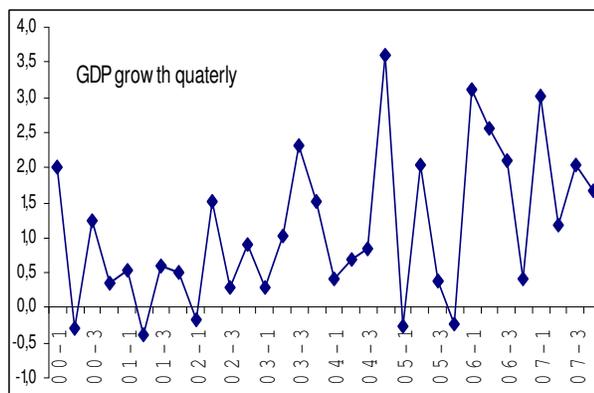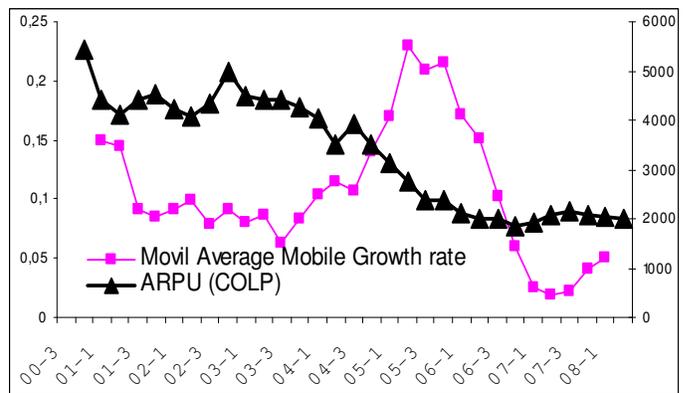
Source: Ministry of Communications.

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From the Dirsi's proyect survey, we observe that many people in Colombia use but do not own a mobile phone set and among those who own one, some of them use it for receiving calls and call from their phones or from the 'informal services'. Recently, the Colombian regulator (Comision de Regulación de Telecomunicaciones) argued that there were justified

reasons to impose a price cap on the calls from the fixed to mobile phones due to the persistent high price differential between fixed-mobile and mobile to mobile calls. Although price differential was one of the possible factors which stimulated the growth of 'informal resale' their use on the streets still continue despite CRT's new rules.

The conjunction of these facts let the whole telecommunications sector grew at higher rates and it also changed its composition. In the middle of nineties, the main telecommunication sub-sector was the fixed telephony and now the leader is the mobile. Between 2004 and 2007 the number of users grew 227 percent and the mobile sector increase its share in the sector's income from 11 to 45.6 percent. At the end of 2007 there were about 30 million of subscribers of mobile phone and only about 10 million of fixed telephony subscribers. As Gamboa (2007) shows, that growth was mainly explained by the increase in consumption by people in the bottom of the income distribution and their access through the modality of prepayment (Now, 84 percent of the users are in prepaid option).

Table 1

Mobile Market	1996	2002	2004	2007
Total owners of mobiles (Millions)-b	0,52	4,59	10,4	33.9
Mobile Penetration (owners/population) a	1,3%	10,6%	23,2%	71,3%
Prepaid/Total -b	n.a	n.d	73,9	90.2
(Herfindhal Hirschman Index)-b	0,5	0,55	0,42	0,58
Market Share of two highest firms -b			87,6%	90.4%
Share of Telecommunications Sector	11,0%		29,6%	45,6% c
Fixed market				
Main Lines (millions) a	4,64	7,76	7,58	n.d
Fixed Penetration (Lines/population) a	11,8%	17,8%	16,9%	n.d
Share of Telecommunications Sector	36,1%	n.d.	32,6%	31,7% c
Gross Domestic Product per capita				
n.a Not applicable n. a Not available a- World Development Indicators b- Ministry of Communications c- year 2006				

From the industrial organization point of view, although there are three firms in the market, one of them leads the market with 66 percent of the users (*Comcel* which belongs to the *America Movil* group). The others are firms that have changed their owners and their commercial brands during a short period. One of them is *Movistar* (*Telefonica*) that purchase the assets of Bellsouth that previously had bought *Celumovil*. The last entrant firm that was created by an alliance between the two largest local fixed telephone companies started under the brandname of *OLA* but two years later was acquired by *Millicom* that changed its brandname to

TIGO. Now, all the three mobile operators belong to multinationals: América Móvil (México), Telefónica (Spain) and Millicom (Luxemburg).

As explained above, in Colombia emerged a new way people can use to minimize their expenditure in mobile telephony. It consists of buying minutes on the streets and small commercial places. In its beginning this new business let people who did not own a phone set to make calls. Then, it was also a good alternative (or complementary way) for people using the modality of prepayment. This paper intends to characterize what determines the probability of use mobile telecommunications by the buy of minutes on the streets and in commercial business for low income people in four different cities in Colombia (Bogotá, Medellín, Pasto and Villavicencio).

4. Data

During May 2007, IDRC and DIRSI sponsored a telecommunications survey in several Latin-American and Caribbean countries focused in low income households. The survey included information about access to mobile and fixed telephony, consumption and usage patterns and usage perspectives, but only for Colombia's survey, questions regarding the buy of informal re-sale of minutes were implemented so the research cannot be done for the entire region. In Colombia, 800 people were surveyed living in four cities: Bogotá, Medellín, Pasto and Villavicencio. In this survey, we found that 713 respondents (89 percent) used mobile telephony but only 61 percent (492 people) owned a mobile phone. We also found that people who used prepayment plans preferred to have a phone for receiving calls rather than for making them. Form the survey, we also found that only the 37 percent had both mobile and fixed phones and about 10 percent of the respondents did not have any of them. This finding implies that about 50 percent of the people only had *one* of these two means of communications. It is a high percent of people though but it is not unexpected due to the credit and income constrains those people face and because most of them lived in a rent house too. In Colombia, it is common that people who rent a house do not let tenants to contract main lines with fixed telephony providers if they are low-income people.

Table 2 Mobile and Fixed users distribution among Respondents

		Fixed phone		
		Yes	No	Total
Mobile Phone	Yes	301 (37.63)	191 (23.88)	492 (61.5)
	No	204 (25.50)	104 (13.0)	308 (38.5)
	Total	505 (63.13)	295 (36.88)	800 (100)

From Table 3, we can state that people from the survey had a monthly income near to one hundred dollars and most of them did not have complete education (high school). As we mentioned in a companion paper, Gutierrez and Gamboa (2007), post paid contract users use mobile phones more frequently than prepay users. Another interesting finding is that mobile users in the survey have been new-comer mobiles users, on average, from 2003-2004. As we say above, mobile in Colombia started in 1994.

Table 3 Summary statistics

	N	Mean	Stdar Dev.	Min	Max
Age	492	36,48	12,23	15	70
Per capita income (US dollar)	492	116,26	101,26	0	782,89
Years of education	492	8,449	3,803	0	17
Overcrowding	492	1,995	0,935	0,5	6
Female	315	64,02%			
Fixed	301	61,18%			
Mobile					
Prepaid	439	89,23%			
No calls made (*weekly*)	380	12,6	13,94	1	100
No. calls received (*weekly*)	417	13	14,3	1	50
SMS sent (*weekly*)	114	7,94	10,1	1	60
daily spending	387	0,21	0,21	0,014	1,49
Years of use	439	3,27	2,24	0	11
Post paid	53	10,77%			
No calls made (*weekly*)	52	33,53	35,57	2	100
No. Calls received (*weekly*)	53	29,77	33,63	2	100
SMS sent (*weekly*)	23	11,17	10,51	2	50
Daily spending	52	1,45	0,824	0,351	4,38
Years of use	53	3,79	2,552	0	11
Informal users	376	76,42%			
No calls made	339	14,44	16,62	1	100
No. calls received	363	14,98	18,62	1	180

The most important fact from the results of the survey is that about three quarters of the people that own the phone set uses informal re-sale of calls and most of them were mobile users in the modality of pre-payment. When we estimate their level of use, it is higher than the prepaid mode. The number of users that use informal re-sale of calls but do not have a phone is 183 in the survey (22.89%) and the number of owners that do have it is 372 (76.4% of owners). In the survey, there were four minimizing strategies mobile users could make use: use of beeping, sending of SMS, use the phone only for receiving calls, and buying of informal re-sale of calls. The use of informal re-sale was by far the most frequent strategy used to minimize expenditure by the owners of a mobile phone and SMS was the less used. Women are more prone to use the phone only for receiving calls. Beeping is common in young people as it was expected.

Table 4 Percentage of use of minimizing strategies among mobile owners

	N	Beeping	Phone-receiver	SMS	Informal re-sale
Gender					
Male	177	40,68	48,02	9,6	77,4
Female	315	45,08	61,59	8,57	75,87
Age					
12-18 years	51	49,02	62,75	15,69	80,39
19-30 years	182	55,49	58,24	12,09	78,02
31-50 years	200	33,64	52,5	22,73	73
> 50 years	59	27,12	61,02	6,78	79,66
City					
Bogotá	127	52,67	71,65	14,96	80,31
Medellín	100	43	58	16	65
Villavicencio	149	44,3	44,97	3,36	69,13
Pasto	116	32,76	54,31	3,45	91,38
Quintile of SES					
1	78	37,18	66,67	11,54	78,21
2	96	42,71	67,71	10,42	69,79
3	97	41,24	55,67	11,34	74,23
4	104	45,19	57,69	9,62	83,65
5	117	48,72	41,03	3,42	76,07
Educative Level					
Basic or less	280	37,14	63,21	10	77,86
Secondary	146	50	52,05	8,9	71,12
Superior	66	56,06	39,39	6,82	81,82
Type of Contract					
Post-paid	53	49,06	30,19	7,55	49,06
Pre-paid	439	42,82	59,91	9,11	79,73
Firm					
Largest	348	44,25	58,33	8,62	77,59
Medium	130	40	52,31	8,46	71,54
Small(*)	14				92,9
TOTAL	492	43,5	56,71	8,94	76,42

(*) Due to few data, percentages are not shown.

From the socioeconomic perspective, beeping is positively related to wealth and people in the modality of pre-payment prefer to use the phone for receiving calls but when they needed to make a call, they went to the informal resale. Finally, we found that those users that utilized the firm with lower market share went to the informal resale and it can be explained as a consequence of the price differentials between on-net and off-net calls.

In order to characterize the use of the different strategies users of mobile telephony implemented for minimizing their spending, we sort the users after each strategy. First of all, we found that the 13 percent of respondents only used the informal re-sale. It is important to highlight that more than 60 percent of the users made calls and hung up before the other side answered and only used the phone for receiving calls. We also found that SMS was not more frequently used among the respondents.

Table 5. Distribution of Strategies of Minimization in Sample (%)

	informal use	Beeping	SMS	Phone receiver
informal use	12,26	28,32	5,53	38,34
Beeping		4,31	4,66	18,48
SMS			0,1	6,22
Phone receiver				4,66

5. Model

We want to determine the characteristics of the people that use the informal resale of minutes of mobile telephony. Due to the survey design, we divide our estimation in two separate approaches. First, we only include respondents who owned a mobile phone because many of the questions about use habits are only made on them. In this case, we have 492 observations. Then, in a second estimation, we include all users (713). In this step, some variables as the levels of use and the use of other strategies of minimizing their spending are not available for people that do not owns the mobile phone. In consequence we include other variables which let us to capture the level of using information and communication technologies.

Since our dependent variable is discrete, we use a probabilistic model. In the first estimation, the dependent variable is defined as whether or not an individual *who owned* a mobile set made calls using the mobile telephony service in the streets. Among the explanatory variables we include: type of contract (pre-paid or post-paid), gender, age, socioeconomic status proxied by income, size of the household, labor status, other minimization strategies and mobile operator, use of fixed mobile among others, (for further details on the variable definition see appendix).

We found that people who had the modality of pre-payment has a higher probability of using resale services. This could be a consequence of the fact that the price of calls is different between pre-paid and post-paid modalities or it also could be due to the distance they have to

go for buying a new pre-paid card. Other interesting finding is the significance of the variable 'firmleader' which say us that owners from the higher firm tend to use the informal resale than people from the other firms. The intuition behind this is in the access charges. During 2006 and 2007 prices in *off-net* calls for Comcel users were higher than those from the small-firms. [2] We also found a positive relationship among income and the use of informal re-sale of calls. This particular finding might emerge from the fact that those who have more income in the survey, tend to use more the mobile. Other variables like sensibility and perception give us some indication of the perception the person has with respect to price changes and price structure. They did not affect the use of the informal re-sale. These variables are not significant under the specifications shown

Our second estimation includes all the users. In this case, the dependent variable is defined as whether the person uses or not the informal mobile. The first consequence of the re-definition of the variable is the greater number of observations. Some of the explanatory variables should be modified. Now we include variables like the use of other information and communication technologies (ICTs) and the use of Internet in order to capture the level of use of digital alternatives. For estimation purposes, we use ICT in a separate and in aggregate way.

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[2] The regulator (CRT) start the process of studying a price cap on access prices among fixed and mobile operators as a consequence of this fact

Table 6. Dependent Variable: Use of informal mobile. (Marginal effects)

	(1)	(2)	(3)	(4)
Gender	0,0295	0,0321	0,0323	0,0295
	(0,0680)	(0,0641)	(0,0640)	(0,0680)
Age	0,0347***	0,0351***	0,0352***	0,0346***
	(0,014)	(0,014)	(0,014)	(0,014)
Age2	-0,0004***	-0,0004***	-0,0004***	-0,0004***
	(0,0002)	(0,0002)	(0,0002)	(0,0002)
Log(income)	0,0653***	0,0660***	0,0672***	0,0653***
	(0,0337)	(0,0331)	(0,0327)	(0,0337)
Prepaid	0,6796***	0,6797***	0,6786***	0,6796***
	(0,0351)	(0,0351)	(0,0354)	(0,0351)
Schooling	0,0000	0,0000	0,0001	0,0000
	(0,0006)	(0,0006)	(0,0005)	(0,0006)
small city dummy	0,0829	0,0830	0,0747	0,0829
	(0,0665)	(0,0667)	(0,0656)	(0,0665)
Medellin	-0,1602***	-0,1603***	-0,1530***	-0,1602***
	(0,0792)	(0,0793)	(0,0774)	(0,0792)
Laboral status	0,0098			0,0098
	(0,0624)			(0,0624)
Firm leader	0,2295***	0,2300***	0,2298***	0,2295***
	(0,0591)	(0,0590)	(0,0590)	(0,0591)
Internet user	0,1151*	0,1135*	0,1139	0,0838
	(0,0760)	(0,0748)	(0,0746)	(0,0962)
Size of Household			0,0014	
			(0,0167)	
Owns a Fixed phone	0,0320	0,0320		
	(0,0618)	(0,0618)		
Sensibility to price	-0,0286	-0,0287	-0,0272	-0,0286
	(0,0664)	(0,0664)	(0,0660)	(0,0664)
ICT				0,0320
				(0,0618)
Hosmer-Lemeshow Chi2(8)	22.76	22.22	18.92	22.76
Prob <Chi2	0.0037	0.0045	0.0153	0.003
Pseudos-R	0.43	0.44	0.43	0.43
Log	-259.84	-260.0	-260	-259

Standard Errors in parentheses. *** p<001

We also include a socioeconomic index (SES) which was constructed by principal components and is composed of several items as house materials, economic dependence, head of household' educative level, overcrowding, proportion of children in school, and schooling of people above 12 years old. The SES is a proxy of the standard of living and it lets us to capture the effect of the capital stock on the use of mobile phone. This variable

lets us to replace information of the level of use of cell and fixed phone in the first estimation. Other variables as the level of using phone (fixed and mobile) are included for assessing complementarities but results show that none of them are significant.

Table 7. Marginal effects

Variable	(1)	(2)	(3)	(4)	(5)
Gender	0,000	0,003	0,008	-0,003	0,001
	(0,035)	(0,035)	(0,035)	(0,034)	(0,035)
Age	0,002	0,002	0,001	0,002	0,002
	(0,0019	(0,001)	(0,001)	(0,001)	(0,001)
Log(income)	0,018	0,021		0,017	0,018
	(0,0179	(0,017)		(0,017)	(0,017)
Type of User	0,377***	0,368***	0,359***	0,386***	0,382***
	(0,077)	(0,077)	(0,078)	(0,076)	(0,076)
Small city dummy	0,131***	0,126***	0,133***	0,143***	0,143***
	(0,032)	(0,032)	(0,032)	(0,034)	(0,034)
Laboral status	-0,013	-0,020	0,011		-0,015
	(0,034)	(0,033)	(0,033)		(0,033)
Size of household	0,002	0,001	0,000	0,002	0,001
	(0,009)	(0,009)	(0,009)	(0,009)	(0,009)
Owner	-0,020	-0,019	-0,034	-0,022	-0,020
	(0,034)	(0,034)	(0,033)	(0,034)	(0,034)
Internet user	0,056				
	(0,036)				
Ict index				0,039**	0,038**
				(0,025)	(0,025)
Log Likehood	-316,6	-318	-349,4	-317	-316
Holmer -Lemeshow	13,77	10,06	9,33	8,37	10,88
Prob>chi2	0,0881	0,2205	0,315	0,39	0,2

Standard Errors in parentheses. *** p<001

In this estimation, results are very similar to those in Table 6. We test several specifications and the results are robust to them. For this case, the variable Type of user means that people in the modality of post-payment has a lower likelihood of using informal resale. However it is interesting to find that Internet use have a positive impact on the use of informal re-sale on streets. It can mean that people who are more digitalized need or want to be more in contact with their social networks of relatives and friends. We also find that people from small cities (Pasto and Villavicencio) use more often the informal market for communicating than the people from Bogotá. This result corroborates a finding in Gutiérrez and Gamboa (2008) where they found that people from Bogotá (and México

City) are on average more digitalized. This finding also is unsurprising since people living in the capital have more access to ICT nodes of connections be them fixed telephony, public telephony and mobile. The variable owner seeks to identify if people who has a mobile device tends to use the informal resale with a higher probability with respect to those who does not have it. Although it is not significant, the sign is the expected. As we expected, we found that there are no gender differences in the use of this alternative of communication.

6. Conclusions

Our estimations show that there are different motivations for using the informal resale of mobile minutes on the streets in Colombia. In general terms, people who 'belongs' to the firm leader and who are in the modality of prepayment are more prone to use this way of communication. We also found that socioeconomic status does not seem to affect the use of informal services, although this can be explained by the fact that the survey is focused on people belonging to the bottom of the income distribution.

During the last year, competition among operators has increased and it could let the users to have lower prices. In consequence price differentials between all the modalities of contracts are converging and the question is whether it reduces the incentives to use the informal resale of minutes. If it is the case, policy in communications have to focus in the credit barriers who limit the access to the very poor people when in the developed world the focus is in the determinant of the use of more advanced value added aspects from the mobile telephony. From the supply side, this economic activity is a new alternative for generating any income and it is mostly used for people with a low educative level. But it would be interesting to study more in detail their main characteristics.

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Appendix. Definitions of the variables

Name	Description
Gender	Dummy variable equal to 1 if the person is men, 0 elsewhere
Age	age of the person (continuous variable)
Age 2	age squared
Log(income)	per capita income (in logarithms)
SES	Socioeconomic index (ranges from 0 to 100)
Contract	Dummy variable equal to 1 if the person is in the pre-paid modality, 0 elsewhere (postpaid or not own the phone)
Education	Years of schooling
Medellin	Dummy variable equal to one if the person lives in Medellin
small city dummy	Dummy variable equal to one if the person lives in Pasto or Villavicencio
Laboral status	Dummy variable equal to one if the person is employed and cero if he/she is unemployed or inactive
Size of household	number of people in household
phone reception	Dummy variable equal to 1 if the person only use the mobile for receiving calls
Owns a Fixed phone	Dummy variable equal to 1 if the person has a fixed line in household
Perception	Equal to 1 if the person thinks mobile is costly
Sensibility to price	This is a dummy variable constructed from a question done to people about their probability of change the use when price change (up and down). It is equal to 1 if the person change her level of use when price change
Type of User	Dummy variable equal to 1 if he/she does not have a mobile or have it in the modality of prepayment
Owner	Dummy variable equal to 1 if he/she owns a mobile phone
Mobile calls	Number of calls made from a mobile phone
Fixed calls	Number of calls made from a main (fixed) phone
Total calls	Mobile + fixed calls
internet	If the user use internet during the last month
Use of internet	Number of days in which he/she used internet during the last month
ICT index	Internet +fixed. Then it takes values from 0 to 2.
Other strategies	It is a categorical variable that goes from 0 to 3 if people use none, one, two or tree strategies of minimizing their mobile spending