

INEGI

METHODOLOGICAL NOTE

PRICE INDICE OF GENERIC MOBILE TELEPHON SERVICE

april 2013



INSTITUTO NACIONAL
DE ESTADÍSTICA Y GEOGRAFÍA

Presentation

As of July 15, 2011, the National Institute of statistics and geography (INEGI) is exclusive of elaborating National Prices Indices (NPI). Since that date, the Institute has committed itself to the process of elaboration of the rates respond to the principle of continuous improvement and the implementation of international best practices.

In order to keep informed to society on the methodologies used by the INEGI in terms of national Price Indices, is this note methodological of the index of prices of the generic mobile phone service.

The main objective of this document is to explain the process of elaboration of the price index of the generic mobile phone service, to its integration into the Consumer Price Indice (CPI). The foregoing is seeks to facilitate the use and interpretation of this index, as well as to contribute to the provision of the public service of information and contribute to the development of the statistical culture.

This paper reiterates commitment of the INEGI with the quality and continuous improvement, permanent efforts of review and methodological update of the work under its responsibility, as well as the implementation and consolidation of new studies and projects. This constitutes a fundamental aspect which allows you to generate additional indicators on the State and evolution of various aspects of national life.



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I. Introduction.

The Consumer Price Index which is published biweekly, is intended to measure the evolution in time of the general level of prices of goods and services consumed urban households in the country. The CPI is made by tracking the prices of a basket of goods and services representative of the household consumption at a given moment of time. In the determination of the consumption basket used as a main source of information the Household national survey of income and expenditure (Enigh). From this information is grouped the total consumption expenditure of urban households in representative generic concepts¹ (in the CPI second base half of December 2010 are 283), each of which is assigned a weight which corresponds to the weight that has within the total expenditure.

I. 1. Premises.

During the year 2010, the Bank of Mexico carried out the change of base, basket and weights of the CPI, which applied from the first half of January 2011. This update of the basket involved the disappearance of some generic products and the incorporation of new ones in the front base (second half of June 2002) were considered as specific products but that its importance became a generic.

Mobile phone service is one of those new generic products from January 2011. On the previous basket was considered as a specific product within the generic of fixed telephony.

I. 2. Price's indices for generic products.

Generic products price indices are calculated in two ways, one is without differentiating the importance of each of the specific products that compose it and the other is done with weights differentiated by specific.

In the first method the index of prices of generic products is calculated as no weighted average of each of the specific products that compose it and the other with weights differentiated by specific.

However, there are special cases in which weights are used for specific products that compose it, these rates include by services, such as: mobile phone, electricity and highways fees. A telephone company may charge a price for calls placed to users from the same company and another for calls to companies outside of your network. In this case, to calculate the price of the generic index it is necessary to assign weights to the various components of the service.

¹ Generics group specific products with similar characteristics and constitute the lower unit weighting within the CPI, for example, cereal flakes. The specific are products or services that have great detail in its description, including brand or model, such as Cereal brand X, 400 grams box sold in the source Y.

The purpose of this document is to know the methodology with which prepares the index of prices for the generic mobile phone service, to its integration into the Consumer Price Index (CPI).

II. Model objective.

That index of the generic mobile phone service save the representativeness and reliability necessary to be able to reflect the behavior of mobile phone service prices, taking into account the different rates, plans and services purchased (voice, short message (SMS for its acronym in English) and data).

III. Approaches to measure changes in the prices of telecommunications services

The telecommunications sector has changed dramatically in recent years. Technological innovation has resulted in the proliferation of new services, while deregulation has generated an increase in the number of providers in many countries. Altogether, these factors led to the suppliers to adopt a range of new strategies to differentiate their services in order to attract and retain customers.

It is becoming more common to telecommunications companies to offer services through plans that require customers to enter into contractual relationships longer term with the supplier. This raises challenges to develop the index. Generally, there are two kinds of plans: the first does not have a fixed duration and allows that the provider, prior notice to consumers, modify the structures of pricing (prepaid plans); the second kind of plan, most widespread, establishes contracts for a fixed term (usually from one to two years) and fixed prices for the time that the contract lasts. These plans differ depending on the prices to charge for various services (postpaid plans).

III. 1. Recommendations of the CPI's manual.

Since the telecommunications sector is continually changing, it is necessary that statistical methods are subject to constant revision. The following is an overview of four approaches that currently used national statistics agencies and is recommended in the "Manual del Índice de Precios al Consumidor, Teoría y Práctica"² chapter 10. Pages

²Manual edited by altogether: the International Labour Organization, International Monetary Fund, the Organization of economic cooperation and development, the Statistical Office of the European communities, the United Nations and the World Bank.

225-229. Paragraphs: 10.90 to 10.116 to measure changes in the prices of telecommunications services:

Comparable samples.

- With supplier data representative articles are chosen by type of service, with weightings.
- For each item a sample of features that is kept constant between one period and another.
- Variations in the indexes are calculated based on the variations of prices from this comparable sample.

Unit cost.

- The price of each representative item is calculated from information on income and amounts provided by the service provider.
- Approach assigns the price all the differences among plans, time and duration of calls, why should build for homogeneous items.
- It is considered that this approach provides a method to explain the change in prices when items are subject to a proliferation of discounts or promotions.

Users profile.

- Usually classify consumers according to the volume of use of the services.
- To estimate the costs faced by average consumers in each period you can resort to the rates stipulated in the existing plan that is more applicable to each category.
- The activity of consumers (in terms of quantity and type of calls) is kept constant between the periods of comparison.
- Calculations are made from a representative sample of suppliers, using information about their global participation in the market.

Bills sample.

- Each month determines the price of a fixed level of use of the service by a real sample of customers.
- You must select a sample of each category of customers (high-volume customers, medium and low), and ideally your bills should cover the activity of a full year.
- It is necessary to have monthly information on the relative importance of the different plans in each category of client.
- It is important that the sample of invoices is updated periodically to reflect changes in consumption patterns and the hiring of new services.

III. 2. The cases of Italy, Spain and USA.

This section summarizes the characteristics of the models that employ the statistical offices of different countries, in the elaboration of the index of prices of mobile phone.

[Italian Model](#) . –Istituto Nazionale di Statistica (ISTAT), the mobile phone calculus model, uses the user profile approach:

- It includes voice and SMS services through simulated loads.
It is considered the range of rate plans offered by the major national operators that act on the residential market.
- It uses a sample of 256 profiles.
- It includes both new and old plans that are still available.

[Spanish Model](#) .- Instituto Nacional de Estadística (INE), the mobile phone calculus model, uses the user profile approach:

- Looking at you, SMS and internet services.
- Takes into account all companies and patterns product representative, the sample is 30 out type.

[USA Model](#).- Bureau of Labor Statistics (BLS), its calculation model is a hedonic model with focus on unit prices, fed with information obtained from data collected directly from stores in each city that makes up the index. It is a rotating sample of shops and products, it should be noted that the same product they do not constantly quote. The rotation is done 100% every four years. They capture information on prepaid and postpaid, any charge that is made in these plans is added to the total payment. They exclude some services such as payment of long distance calls and the cost of the equipment. Consider the price of the service the transmission of data and messages, as well as other services that are contracted as additional. In any case catch plans and services to companies. The model considers voice, messaging and internet services.

III. 3. Focus on the model of calculation in the CPI.

The model which is currently calculated the price of the generic mobile phone service index resulted from observation of the dynamics of the market, review of international manuals and queries to different institutions that are responsible for the same calculation of variation of prices in mobile telephony (Spain, Italy and United States), as well as the International Monetary Fund. The services that are included in the model considered both the sending of text messages and voice and data transmission.

This model is built by analyzing the information available on products offered on the market and monetary fixed consumption, which leads us to construct a model under the 'User profile' approach, in combination with unit prices.

According to the information available and the factors that they affect on the price paid for the services identified, held the classification of users of mobile telephony under the following criteria:

- Company with which it has contracted service.
- Form of payment.
- Old line.
- In the case of prepaid recharge amount.
- In the case of postpaid plan type³.

Table 1. Users profile of mobile telephony services Index

Modality	Specifications	Recharge
Prepaid	New clients	\$100; \$200; \$300 and \$500
	Mature clients	
	One or more years clients	
	It does not distinguish between customers	
Postpaid	Fixed consumption	
	Measured consumption	

28 Profiles of prepaid and 6 postpaid were defined in this way. The price of these profiles is calculated by assigning one or more plans for company which conform to the definition of each profile, in accordance with the offer available at the time of quoting.

The ideal way to approach the profile of users is to know the volume or basket of services consumed by each element in the sample, this calculate the cost in each period to obtain the variation. In this case, and given the information available is used the combination of unit values and calculated an implicit price⁴ for each profile per unit of service for every concept in the period.

³ Refers to plans of measured consumption where in case of exceeding the contracted plan consumption, the company adds this surplus to the invoice, and fixed consumption plans where at the end the contracted services basket is suspended outbound service unless you recharge airtime.

⁴ Implicit Price. Amount to pay for a service between the amount of service acquired.

The focal point is the price of services, given that services providers, there are rates differentiated between calls to phones owned by the same company and cell phones from other companies. Similarly, rates change depending on the nature of the balance, whether it is paid or promotional, and promotions apply differently depending on the contracted plan and if made recharge amount.

IV. Concepts and scope.

IV. 1. Focus on acquisition of price indices.

In agreement with the Manual indices of prices consumer theory and practice is often distinguished between the acquisition of goods and services for consumption by households and subsequent use to meet their needs or desires.

The distinction between the acquisition and the use of a good or service consumption led to propose two concepts of IPC:

- CPI can be made thinking on measuring the average exchange, between two periods of time, in the prices of goods and consumption services purchased by households.
- Alternatively, with a CPI you may try to measure the average variation, between two periods, prices of goods and consumer services used by households to meet their wishes and needs.

A CPI based on the approach of using must measure changes from a period to another in the prices of services workflows that provide goods and services. The workflow value of the services of a good can be estimated by using his "user cost", which consists essentially of depreciation of the asset (at current prices) plus the cost of the interests. It is difficult to estimate the values and prices of flows of services derived from the stock of assets that possess households; on the other hand, prices that are bought is easy to register them. Due to these practical difficulties of measurement, so far the CPI is based largely or entirely on acquisition approach.

IV. 2. Mobile telephony service concepts.

Prepaid. Described as an advance payment for the service to be received, does not have a fixed duration and allows notice to the supplier, to consumers, to modify the structure of pricing. In this mode, once reached the consumer bought early outgoing service is suspended and is not possible to reset it until you do a recharge (additional purchase of air time). This service is given with charges from \$20 thereafter. According

to information from the ENIGH 2010 and The Competitive Intelligence Unit⁵, most of the market consumes charges of 100 pesos or less,

Postpaid. Establishing contracts for a fixed term (usually for year and a half to two years) and fixed rates for the time that the contract lasts. Works providing the same service but the modality is that if it exceeds the consumption of the contracted plan, company invoice total and charge it to the cut-off date.

Mixed. As in the previous case is set a duration and fixed rates contract during the set time, but with the difference that at the end of the tariffs services contracted basket is suspended outbound service, this can resume in two ways: the first is buying additional air time through top-up and the second time is to wait for the beginning of the following period for the basket of services corresponding.

Contracted plan. These are the products offered to consumers, can be in the form of pre-or post-paid. Each plan is directed to a user depending on the consumption profile. Those entering the system with a new line also have services and rates differentiated to those who have seniority with the service from the same company. In terms of modalities, there are dozens of variants in the various providers.

IV. 3. Scope.

This indicator refers to the average change in prices in the mobile phone services purchased by consumers of voice, short message (SMS) and access to the internet, including payments of postpaid and prepaid with national coverage.

The evolution of the model is motivated by the way in which it behaves the Mexican market of mobile telephony to represent reality as faithfully as possible. For this reason the model will be in continuous update depending on the changes in the form of marketing of the service of mobile telephony as well as new services that are becoming representative of the average Mexican household consumption.

⁵ In the article "Market of recharges cell phones" published in 2012, based on a survey carried out during 2011 can be found in http://www.the-ciu.net/nwsltr/020_1Recargas.html

V. Methodology.

The current methodology for calculating is derived from periodic revisions and setting that is conducted in the CPI, so keep the representativeness and reliability. This methodology is based on the recommended approaches, in the manual of the ILO, according to information available to Mexico.

The following are general guidelines that are used to define the model used in the calculation of the index of the generic mobile phone service from the CPI, from April 2012.

V. 1. Determine plans to follow.

Taking into account the characteristics of the processed profiles is assigned to each profile one or more of the existing plans that are more applicable to each phone company.

This sample is changed depending on the availability supply of plans, both prepaid and postpaid, selecting plans that best represent the preferences of consumers. When it is necessary to replace any of the sample plans, either because you have stopped selling, it has discontinued or ceases to be a representative the replacement is done gradually, over a period of six fortnights, due to migration to be given prior to the new plan.

For selection schemes to existing tracks, as well as to determine the effective date, is considered the information that companies publish in their websites, which will be updated periodically according to the evolution of the market.

V. 2. Estimation of the subsystem weights.

Refills.- For estimation of average spending in recharges as well as for the participation of the amounts of recharge took as a basis the elaborate mobile users profile information by 'The Competitive Intelligence Unit'⁶ en 2011(see Anexo1). Such information from spending as well as participation are contrasted and validated with the information reported by the national survey of income and expenditure of households (ENIGH 2010) in 2010.

⁶ The Competitive Intelligence Unit (The CIU) is a consulting firm specializing in telecommunications and technology of information, of international scope.

According to this information was estimated the distribution that have different amounts of recharge because users access rates and different promotions depending on the reloaded amount.

Table 2. Participation of charge used in the calculation of the subsystem of mobile telephony.

Average expenditure	Weight
\$ 100	65.46
\$ 200	26.31
\$ 300	2.74
\$ 500	5.49

Services.- The participation of the main services of mobile consumption (voice, SMS and data) for the average user was estimated according to figures reported by The CIU (see Annex1), since this report has a disaggregation by type and use of services (voice, SMS and data). Published figures is an estimate of income and ARPU per user (for its acronym in English) for each group the classification by intensity of use of the services performed, as well as the proportion of expenditure in each service within the groups. With this information it is possible to estimate the average monthly expenditure per user at each service and later the participation of services within the expenditure of the average user.

Table 3. Distribution of average expenditure per service.

Service	% of expenditure
SMS	28.2
Voice	50.4
Data	21.4

The participation of the companies was estimated by city according to information provided by the same companies, which publishes the Federal Telecommunications Commission (COFETEL), and various surveys conducted by the INEGI: obtained the market share of vendors within the 46 cities comprising the CPI. Similarly, the distribution services of pre and post-paid for each company within the 46

cities was estimated. The weights as well estimated will be updated on a regular basis in accordance with the availability of the information.

V. 3. Compilation of prices.

The rates and promotions that apply in the calculation of this indicator are collected from operators sample web pages in a direct way, as well as in the different media that used the companies to keep in touch with their users to clarify and answer questions: lines of customer service, chat users and enterprise social networks.

In the case of postpaid plans considered price is the package, with fixed characteristics. In the case of prepayment, is given follow up to prices by the recharges payment, since it is through promotions recharging as mobile telephone companies affect the price of the services to the final consumer, to have a scheme of discretionary pricing according to the plan, to which belongs the user and the amount paid.

Promotions that are included in the calculation are those that comply with the following characteristics:

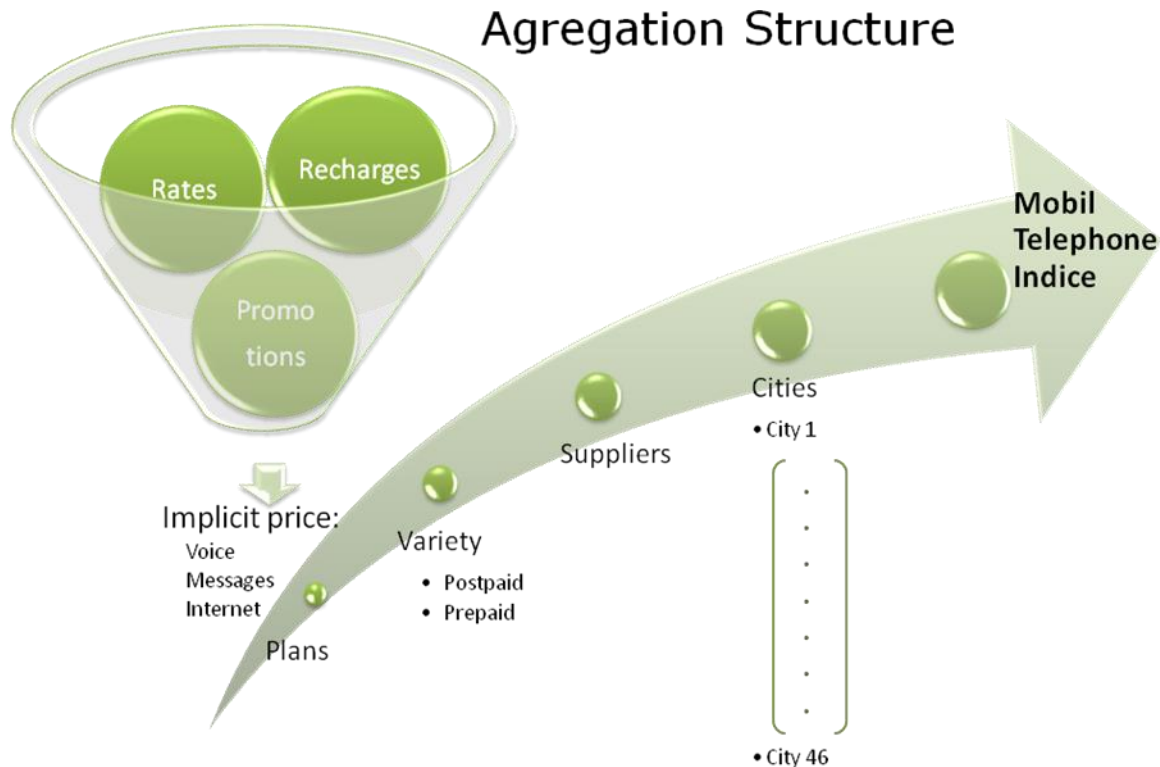
- a) They are of general application to all users.
- b) They are not conditioned, that at the time of purchase don't must be an action in particular to receive it, like sending a message.

VI. Calculation and aggregation.

Features of the model for calculating the index of mobile phone service:

- It is considered the major plans, both prepaid and postpaid from the four most important companies in the Mexican market.
- It takes into account the market share of the companies that offer the service, both prepaid and postpaid within the 46 cities, comprising the CPI.
- Weights the participation of the three main services of mobile telephony: voice, messaging and internet.
- The rates obtained for each service according to the quantity of recharge to 100, 200, 300 and 500 pesos remain is it greater weighting of \$100.

- For each plan in sample is collected information about promotions and rates that apply to the use of the services within the network of each company as outside this.



Factors that are taken into account to calculate the implicit price for existing promotion within every fortnight:

- Service amount included.
- Free numbers
- Priority rates numbers
- On net, off net and priority rates.
- Time air proportion for each service.
- Time air proportion used inside and outside the net.

Rates for voice (on and off net), SMS and data that apply according to the amount of recharge and contracted plan are considered. Promotions are distributed in accordance with the policies of use that determines the company. A case may be that of a promotion that gives additional air time to an acquired (purchase \$100 and receive \$130) the additional airtime can be used only on calls and messages between users of the same company, does not apply to call outside the network.

With the implicit prices of each promotion is calculated an average price per service for every recharge according to the plan selected, weighted by the number of days of validity of each promotion. The above in each company and within each city, i.e. 1288 average prices for each of the listed services are calculated: voice, messaging and data. Annex 2 presents the formulas with which the calculation is performed.

With the distribution of recharges 1288 average prices are integrated obtaining first 322 groups, one for each selected plan and then the same company plans averaged obtaining 184 prices, one for each company within each city.

An analogous procedure is carried out in the case of postpaid, thus integrates an index for each company in each city, taking into account the weighting for both pre and post-paid.

The cities index is calculated as the average weighted index of the four companies, with the participation of the companies by city. Finally the generic national index is added with the weights that were obtained from the ENIGH 2008, based on the second fortnight of December, 2010.

Annex 1

According to information published by The Competitive Intelligence Unit⁷, given the major components of mobile consumer: voice, data and SMS, can be classified three levels of connectivity with respect to the trend in the use that the users give.

Cuadro 1.

Connectivity	ARPU*	Use distribution	Equipment		Market sharing	Smartphones
			Availability to pay	Price/G Annual		
Intensive	\$ 580	SMS 6%	\$ 4,000	57%	11%	61%
		Voice 56%				
		Data 38%				
Medium	\$ 170	SMS 26%	\$ 3,000	147%	31%	15%
		Voice 55%				
		Data 19%				
Limited	\$ 83	SMS 60%	\$ 1,000	100%	58%	2%
		Voice 38%				
		Data 2%				

Source: The Competitive Intelligence Unit 2011

* Revenue per user, by its acronym in English.

⁷ In the report "Profile of mobile users: habits of consumption and type of devices preferred" http://www.the-ciu.net/nwsltr/003_1PerUsuaMov.html

Annex 2

Then presents the formulas that are used in the calculation of the price of the generic mobile phone service index, the exhibition will go from the general to the particular.

Mobile phone service index

$$ITM = \sum_{i=1}^{46} (\omega_i * Icd_i)$$

Mobile phone index by city

$$Icd_i = \sum_j (\gamma_{ji} * Icia_{ji})$$

Indice by company

$$Icia_{ji} = \pi_{ji} * Ipre_{ji} + (1 - \pi_{ji}) * Ipost_{ji}$$

Where:

- ω_i = Generic weight for the i city; $i = \{1, 2, \dots, 46\}$.
- γ_{ji} = Weight for j company in the i city.
- $Icia_{ji}$ = indice of j company in the i city;
- $Ipre_{ji}$ = Prepaid indice for the j company in the i city.
- $Ipost_{ji}$ = Postpaid indice for the j company in the i city.
- π_{ji} = Weight for prepaid in the j company in the i city.

Postpaid Indice

$$Ipost_{ji} = \sum_k (\varphi_{kj} * Prpost_{jik})$$

Prepaid Indice

$$Ipre_{ji} = \sum_l (\theta_l * Iser_{jil})$$

Indice for service in prepaid

$$Iser_{jil} = \sum_r (\lambda_{jr} * Prser_{jlr})$$

$$Precio\ relativo = \frac{Precio_t}{Precio_{t-1}}$$

Where:

$Prpost_{jik}$ = Relative price for postpaid k plan to the j company in the i city.

φ_{kj} = Weight for the postpaid k plan of the j company.

$Iser_{jil}$ = Service Indice / for prepaid to the j company in the i city.
 $l = \{\text{voice, SMS, data}\}$.

θ_l = Service use weight / Prepaid.

$Prser_{jlr}$ = Service relative price / Prepaid plan r to the j company.

λ_{jr} = Prepaid r plan weight to the j company.

The following formulas are used within each city you omit the subscript i referring to the city.

Average price per service and plan:

$$Prppser_{jlr} = \sum_n \mu_n * Piser_{jlrn}$$

Where:

$Prppser_{jlk}$ = Average price for service⁸ / in the r plan to the j company.

$Prser_{jlrn}$ = Implicit Price from service / in the prepaid r plan to the j company with the n recharge.

μ_n = Weight to the n recharge.

⁸ In the case of postpaid plans considered is the plan considered as a package with fixed characteristics.

Implicit Price for service.

To calculate the price per unit of service are considered promotions and rates that apply to the use of service within the network of each company as well as outside this (on net and off-net): the above, in accordance with the amount of recharge and contracted plan and prepaid for promotions that apply every day of the fortnight, taking into account the distribution of the expenditure of an average consumer and the composition of the market of mobile telephony in the city. Promotions of free numbers, messages or included MB that apply is also considered. The promotional air time is distributed in accordance with usage policies that determines each company.

In general terms the way with which the implicit price of each service provided by the plans in sample is calculated is as follows:

$$Piser_{jlrn} = \phi_l Re_{jrn} \left[\sum_h \left(\frac{\phi_l * S_{jrn} * \beta_j}{Ton_{jlrnh}} + \frac{\phi_l * S_{jrn} * (1 - \beta_j)}{Toff_{jlrnh}} \right) + Pmser_{jlrn} \right]^{-1}$$

Where:

- j = Company in sample
- l = {Data, SMS, Voice}
- n = {\$100, \$200, \$300, \$500}
- h = {paid, free}

$Piser_{jlrn}$ = Service price⁹ / in the prepaid r plan to the j company with the n recharge.

Re_{jlrn} = Quantity effectively paid for the n recharge in the prepaid r to the j company (current pesos).

ϕ_l = Weight of expenditure destined to use service l in prepaid.

S_{jrn} = remainder received for h promotion with the n recharge in the r prepaid plan to the j company.

β_j = Market Sharing¹⁰, in lines, of the j company.

⁹ It is measured in pesos per: minute, message or KB as appropriate voice, SMS and data service.

- $T_{on_{j|rn}h}$ = On net rate for h promotion with the n recharge in the prepaid r plan of service l to the j company.
- $T_{off_{j|rn}h}$ = Off net rate for h promotion with the n recharge in the prepaid r plan of service l to the j company.
- $Pmser_{j|rn}$ = Promotion quantity included of service l in the prepaid r plan of the j company with the n recharge.

¹⁰ It can be interpreted as the probability that a call is made within the network of the company in which the line is registered

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