Mobile Telephony in India: Would Cheaper Rates Bring More Profits?

Prerequisite Conceptual Understanding


Synopsis of the Case Study

In 1995, when mobile services were introduced in India, tariffs were as high as INR 16/minute and a handset would cost minimum of INR 15,000, making mobile phones affordable only by the affluent. In India, where consumers are price sensitive, there were not many takers for mobile services at such high tariffs. In the initial years, all the mobile companies were in heavy losses, and it was very clear to them for a price elastic good like mobile, decreasing tariffs was the only way to generate revenue. In 1999, when there were only 1.2 million subscribers, mobile rates were slashed by 60% and from then on the demand for mobile phones started rising and by the end of 2008, the mobile subscriber base in India stood at 346.9 million.

Pedagogical Objectives

- To understand the concept of elasticity of demand and discuss various types of elasticity of demand
- To understand the link between price elasticity of demand, revenue and business decision.

This teaching note was written by Hepsi Swarna under the direction of Akshaya Kumar Jena, IBSCDC. It is only an illustrative orchestration of the case study ‘Mobile Telephony in India: Would Cheaper Rates Bring More Profits?’. It is never meant to limit the learning outcomes.

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Assignment Questions

I. Explain elasticity of demand for mobile phones in India and the types of elasticity of demand.

II. Analyse how price elasticity of demand impacts the revenue of mobile phone companies and bears upon their business decisions.

Teaching Plan

The Teaching Note and Structured Assignment of the case study follow a specific Teaching Plan [Annexure (TN)-I].

Case Analysis

I. Explain the elasticity of demand for mobile phones in India and the types of elasticity of demand.

I started explaining the meaning of elasticity of demand. Elasticity of demand is a way of quantifying how responsive demand is to the changes in the determinants of demand. I asked the class the possible factors influencing demand. Incorporating the response of the class, I discussed the three types of elasticity of demand namely (a) Price Elasticity of Demand (PED) (b) Income Elasticity of Demand (IED) (c) Cross Elasticity of Demand (CED).

PED is the measure of the degree of responsiveness of the quantity demanded of a good to a change in its price. The formula for PED is:

\[
\frac{\text{Change in Quantity Demanded}}{\text{Proportionate Change in Price}} = \frac{\text{Proportionate Change in Quantity Demanded}}{\text{Original Quantity Demanded}} \times \frac{\text{Change in Price}}{\text{Original Price}}
\]

By way of explanation, I presented a situation before the class of 80 students by asking the question: If a smart mobile with requisite features for your needs costs you INR 20,000 how many will go for this, assuming you do not have such a mobile? After head counting, I got the answer. Then I repeated the same question, only changing the price from INR 20,000 to INR 12,000 for the smart mobile. Again after head counting, I got the answer. The first answer was 40 and the second answer was 60.

With the following information:

\[
\begin{align*}
\text{Price (Original)} & = 20,000 \quad \text{(2)} \\
\text{Price (New)} & = 12,000 \\
\text{Q Demanded (Original)} & = 40 \quad \text{(3)} \\
\text{Q Demanded (New)} & = 60 \quad \text{(4)}
\end{align*}
\]

I asked the students to find out Change in Quantity Demanded and Change in Price and put them thus:

\[
\text{Change in Quantity Demanded} = 60 - 40 = 20 \quad \text{(4)}
\]
Change in Price = 12,000-20,000 = -8,000 …….. (5)

To calculate the price elasticity, I substituted the numerical information contained in (2), (3), (4) and (5) into the formula contained in (1). The result was:

\[
\frac{20}{40} \times \frac{20,000}{-8,000} = 1.25
\]

I impressed upon the students that one of the most important things to remember is that PED is a negative number, because the price and quantity demanded, move in opposite directions. When price falls, quantity demanded rises and when price rises, quantity demanded falls. But the negative sign is ignored to measure the magnitude of the PED.

I then proceeded to interpret what the value 1.25 indicates. Before doing that I explained to the class the three types of price elasticity with reference to the magnitude of the PED:

- If PED > 1, Demand is relatively more elastic (Demand is sensitive to price changes). Here 1% change in price will call forth more than 1% change in quantity demanded.
- If PED = 1, Demand is unit elastic. Here the percentage change in quantity demanded is just equal to the percentage change in price.
- If PED < 1, Demand is relatively inelastic. Here 1% change in price induces less than 1% change in quantity demanded.

After explaining the above, I asked the students: What does the value 1.25 indicate? An obvious answer was that the value 1.25 indicates that the mobile under discussion is price elastic and hence its demand is fairly sensitive to price changes. Goods like mobile, refrigerators etc. have price elastic demand. I made it clear to the students that the term elastic and inelastic are used in relative sense. Elasticity is just a matter of degree. In real world it is not possible to find a good which has a completely elastic demand. In economics, when a good has an elastic demand it means that demand for it is relatively more elastic.

Using the data in the equations (2) through (5), PED can be shown graphically [Exhibit (TN)-I].
I gave a problem to the students, resolving which the students will get price inelastic demand:

Price (Original) = 4
Price (New) = 5
QDemanded (Original) = 120
QDemanded (New) = 110

What is the magnitude of PED?
(Ans: 0.33)

I asked the students to plot the above information about price and quantity demanded on a graph and kept a sample graph [Exhibit (TN)-II] ready for explanation.

I cited the example of salt as price inelastic, as people would consume almost the same quantity of salt, whether it becomes slightly cheaper or costlier than before.

I gave an example graphically, which shows a unit price elasticity of demand [Exhibit (TN)-III] and asked the students to write down the price-quantity information from the graph to calculate the magnitude of PED.
Ans:

Price (Original) = 10
Price (New) = 15
Q Demanded (Original) = 20
Q Demanded (New) = 10
PED = 1

I asked the students to tell whether the demand for mobile services in India is price elastic or price inelastic. We discussed the case facts that the Vodafone Public Policy series published in January 2009 indicated the value of price elasticity to be 2.12. This implied that a 10% price increase would reduce demand for mobile phones by around 21%. Thus, the demand for mobile services in India is price elastic.

It is beyond doubt that Indian consumers are very price conscious, because when mobile services were introduced in 1995 there were not many takers for it, as the outgoing call rate was INR 16/minute, incoming call was INR 8/minute and the cost of a mobile handset was INR 15,000 and above. The reason behind such high tariffs was that mobile carriers paid a heavy license fee to provide mobile service, and they could recover it only by charging high tariffs. In the initial years, mobile subscriber base did not increase much, as owning a mobile was beyond the common man’s reach; only the rich could afford it. At the end of 1999, the mobile subscriber base stood at just 1.88 million and the mobile phone industry was sunk in heavy losses.

The government and the mobile service providers realised that such high tariffs will never get more customers. Thus the government introduced a new telecom policy called NTP 99, through which the telecom industry moved to a revenue sharing regime. Under the policy, license fee was reduced, which reduced the tariffs by 60% and most importantly incoming calls were made free. Then onwards, the mobile telephony revolution started booming. In 2005–2006, there were 90 million subscribers and by the end of 2008, the total mobile subscribers were nearly 347 million. Exhibit 1 of the case study shows the growth in mobile subscriber base in India for the period 1995–1996 to 2005–2006. The reason behind such exponential growth in mobile
Mobile Telephony in India: Would Cheaper Rates Bring More Profits?

subscriber base (Exhibit II of the case study) was low mobile tariffs and availability of cheap mobile handsets. Handsets were available for as low as INR 1,000 by 2008. In 2008, India stood as the second largest market for handsets in the world. In 2008, India also had the second highest minutes of usage per month (Exhibit III of the case study). India is just behind US in terms of minutes of usage per month. International Telecommunications Union has attributed the ever-growing rate of subscriber base in India to “cheap call rates, low-end handsets and network expansion spree” (page 3, para 1 of the case study).

After discussing the three types of PED and checking the assimilation of the concepts with application to the case facts, I discussed with the class about Income Elasticity of Demand (IED).

The IED measures the responsiveness of demand for a commodity to changes in income. It is calculated using the following formula:

\[
\text{Change in Quantity Demanded} \quad = \quad \frac{\text{Original Income}}{\text{Change in Income}}
\]

Then I presented the following example to demonstrate how IED is calculated:

Original income = INR 10,000

New income = INR 15,000

Original quantity of good A = 100 units

New quantity of good A = 140 units

The income elasticity of demand was calculated as follows by putting the numbers into the formula of IED.

\[
\text{IED} = \frac{40}{100} \times \frac{10,000}{5,000} = 0.8
\]

I then went ahead to explain to the students the interpretation of various magnitudes of IED.

• If IED > 1, the good is a Luxury Good
• If IED < 1 (but > 0), the good is a Normal Necessity Good
• If IED < 0, the good is an Inferior Good

Since the IED value of the good A in our example is 0.8, it is a normal good.

After this interpretation of the types of goods on the basis of the value of their IED (including the minus sign), I switched to case facts to interpret the income elasticity of demand for mobile phones. The Vodafone estimate put the income elasticity of demand for mobile phones at 2.45. This indicates that mobile services are a luxury since these are relatively income elastic. “But according to another study using household sample survey data from Karnataka, a State in South India, ‘a rise in monthly income of households by 5% increases mobile phone services to the extent of 0.638%’, which makes mobile a normal necessity rather than a luxury good.” (page 3, para 3 of the case study). I explained to the students that a particular good may not be permanently treated as a luxury good or a necessity. Yesterday’s luxury may be today’s necessity.

Then I moved on to a discussion on Cross-Price Elasticity of Demand (CPED) which measures the rate of responsiveness of quantity demanded of a good to change in a price of its related good. If a good has a substitute and the price of the substitute rises, the demand for the good increases. On the other hand, if a good has a complement and the price of the complement rises, the demand for the good decreases.
The formula for calculating CPED is:

\[
\text{CPED} = \frac{\text{Change in Quantity Demanded of } X}{\text{Original Quantity Demanded of } X} \times \frac{\text{Original Price of } Y}{\text{Change in Price of } Y}
\]

I gave an example containing the following information and asked the students to calculate CPED:

- Original price of Y (a related good of X) = 10
- New price of Y = 11
- Original quantity demanded of X = 20
- New quantity demanded of Y = 25

By filling in the numbers in the formula, CPED becomes

\[
\frac{5}{20} \times \frac{10}{1} = 2.5
\]

For the interpretation of the value 2.5, I gave the following guidelines:

- If CPED > 0, the two goods are substitutes
- If CPED < 0, the two goods are complements
- If CPED = 0, the two goods are independent

As the value of CPED between the two goods X and Y is 2.5, X and Y are substitutes. A price increase of good Y results in an increase in the quantity demanded of good X.

I related the concept of CPED to mobile and fixed phones. “A study using household sample survey data from Karnataka, a state in South India estimated that an increase in access price of fixed phones by 5% would increase subscriptions for mobile phones by about 0.3% while increase in usage price of fixed phones by equivalent percentage would increase subscriptions by 10.6%.” (page 4, para 3 of the case study). I explained that in both cases CPED is positive. Therefore, mobile and fixed phones are substitutes, both on counts of access price and usage price. However, on the count of the former, the substitutability is very weak. I then asked the students the reasons why demand for mobile phones is often almost independent of prices of fixed phone and hinted at the Airtel advertisement showing a crash landed girl, making the life saving call from her mobile from the intractable jungle.

After explaining the concept of elasticity of demand and its various types, I planned to address the link between price elasticity of demand and revenue in respect of a firm.

II. Analyse how price elasticity of demand impacts the revenue of mobile companies.

I reminded the class that price elasticity of demand measures how sensitive the demand for a good is to its price change. Understanding elasticity helps in analysing whether a price increase would raise or lower revenue. This is the dilemma faced by many businesses: whether to raise prices or not. I explained whether a price increase would raise or lower revenue depends on its effect on quantity demanded since:

\[\text{Total revenue} = \text{Price} \times \text{Quantity}\]

If the business knows the price elasticity of demand, it can figure out what will happen to total revenue when price changes:

- When demand is price-inelastic, a price increase would increase the total revenue
- When demand is price-elastic, a price increase would decrease the total revenue
- When the demand is unit-elastic, a price increase would not change the total revenue.
Teaching Note Mobile Telephony in India: Would Cheaper Rates Bring More Profits?

The rationale behind the above three propositions can be obvious if comparison is made between the proportionate or percentage increase in price and the proportionate or percentage decrease in quantity demanded. The relationship between PED and TR can be mathematically proved [Annexure (TN)-II].

Coming to the case facts, I cited the Vodafone Public Policy series which mentioned the value of price elasticity to be 2.12. This means that a 10% price increase would reduce demand for mobile phones by 21%. The mobile companies, being aware of this fact, would not charge high tariffs for mobile services. Otherwise, they will lose more on loss of customers than gain hike in mobile service charges. In 1995, the call rates and the handsets prices were so high, that only the rich could access those services. Thus, the mobile subscriber base did not see any significant improvement in numbers in the initial years. The mobile companies were incurring huge losses, as they were not able to increase their subscriber base. In the year 1999, the government decreased the license fee, which enabled the carriers to reduce the call rates by 60%. The mobile companies understood that higher volumes, rather than high call rates predominate and hence lowering the rates increased their profits.

To increase volumes, the mobile companies drastically cut down the call rates. The mantra worked, and the subscriber base started increasing and it still continues to increase. In spite of the drastic cuts in the tariffs, the mobile companies were still able to make revenue. Total revenue generated by the telecom service sector in 2004–2005 was INR 867.2 billion in India. This meant an increase of revenue by 21% from 2003–2004. Manoj Kohli, joint managing director, Bharti Airtel opines, ‘At a tariff of one-and-half cents per minute, it offers a reasonable margin, which has flabbergasted the world.’” (page 5, para 2 of the case study). Even the falling SMS rates are more than compensated by increase in the SMS volumes and the total revenue generated, registers an increase as a result.

The falling tariffs have resulted in falling Average Revenue Per User (Exhibit VI of the case study), but still the companies are able to make profits since “with falling call rates, the subscriber base increased exponentially”. (page 6, para 1 of the case study). Thus, the mobile companies can maximise their revenues in India by keeping the tariffs low, as demand for mobile phones is price elastic for Indians. Low mobile tariffs also enable huge tapping of the rural areas. In this connection I mathematically explained the relationship between price elasticity of demand and the maximal revenue [Annexure (TN)–III] in order to excite the interest of the students further.

Final Thoughts

In the nineties, only a few were willing in India to burn their hands in the revolutionary business of telephony. The heavy losses put the mobile companies in the dilemma whether to raise tariffs or lower them. Experience in Indian scenario taught them to do the latter. The apparent paradox melts away when one realises the magic of high price elasticity of demand in respect of mobile telephony in India. What was lost in lower tariffs was more than made up by what was gained through heavy volumes. But the price elasticity of demand does not stay put. Hence, prediction of profit margin is not foolproof. How far the mobile companies are willing to reduce the mobile tariffs to increase their subscriber base remains to be seen.
Additional Readings


2. To understand how Indian mobile companies are able to make profits with low tariffs – Agrawal Mohit, “How can carriers make 40% EBIDTA margin at 2 cents/min tariff?”, http://www.telecomcircle.com/2009/02/carriers-ebidta/, February 24th 2009.


Annexure (TN)-I
Teaching Plan

Big Picture
Should mobile telephony charges in India be raised or lowered to attain and sustain profitability?

Teaching Plan Flow

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Analysis Section</th>
<th>Expected Learning Objectives</th>
<th>Forward Linkages</th>
<th>Ideal Duration (min)</th>
</tr>
</thead>
</table>
| 1      | Elasticity of Demand for Mobile Phones | • Meaning and Degrees of elasticity of demand  
• Types of elasticity of demand  
• Price elasticity of demand for mobile phones  
• Income elasticity of mobile demand  
• Cross elasticity of mobile demand | Link between price elasticity of demand and revenue | 45                   |
| 2      | Link between Price Elasticity of Demand, Revenue and Business Decision | • Price elastic demand for mobile phones and its impact on total revenue  
• Viability of business decision |                                          | 45                   |

Prepared by the author
### Annexure (TN)-II
Mathematical Derivation of the Relationship between PED and TR

PED or symbolically put,  
\[ e = \frac{\partial Q}{Q} \div \frac{\partial P}{P} \]

or,  
\[ e = -\frac{\partial Q}{Q} \times \frac{P}{\partial P} \]

or,  
\[ e = \frac{\partial Q}{Q} \times \frac{P}{\partial P} \]

or,  
\[ \frac{\partial P}{Q} = -\frac{P}{Q} \times e \]

\[ \text{........... (1)} \]

Since  \( TR = P \times Q \) and  \( P = f(Q) \)

\[
\frac{\partial (TR)}{\partial Q} = \frac{\partial (PQ)}{\partial Q} = P \times \frac{\partial Q}{\partial Q} + Q \times \frac{\partial P}{\partial Q} = P + Q \times \frac{\partial P}{\partial Q}
\]

or,  \( MR = P + Q \times \frac{\partial P}{\partial Q} \)

\[ \text{........... (2)} \]

Substituting (1) into (2),

\[ MR = P + Q \times \left( -\frac{P}{Q} \times e \right) \]

or,  \( MR = P \left( 1 - \frac{1}{e} \right) \)

If  \( e > 1, \frac{1}{e} < 1 \) and  \( \left( 1 - \frac{1}{e} \right) > 0 \)

Assuming  \( P > 0, P \left( 1 - \frac{1}{e} \right) > 0 \)

or,  \( MR > 0 \), which means TR is having positive slope and increasing.

Similarly, if  \( e < 1, \frac{1}{e} > 1 \) and  \( \left( 1 - \frac{1}{e} \right) < 0 \)

or,  \( MR < 0 \), which means TR is having negative slope and decreasing.

Again, if  \( e = 1, P \left( 1 - \frac{1}{e} \right) = 0 \)

or,  \( MR = 0 \), which means TR is having zero slope and neither increasing nor decreasing.

Prepared by the author
### Annexure (TN)-III

**Relationship between Price Elasticity of Demand and the Maximal Revenue**

 Demand curve shows the relation between P&Q

Where R (revenue) = P × Q

or, \( \frac{\partial R}{\partial Q} = P \times \frac{\partial Q}{\partial Q} + Q \times \frac{\partial P}{\partial Q} = P + Q \times \frac{\partial P}{\partial Q} \)

Maximal R occurs when

\[ \frac{\partial R}{\partial Q} = 0 \]

or, \( P + Q \times \frac{\partial P}{\partial Q} = 0 \)

or, \( P = -Q \times \frac{\partial P}{\partial Q} \)

or, \( \frac{P}{\partial P} = -Q \times \frac{\partial P}{\partial Q} \) (Dividing both sides by P)

or, \( \frac{P}{\partial P} = Q \times \frac{\partial P}{\partial Q} \)

or, \( \frac{\partial Q}{Q} = -\frac{P}{P} \)

or, \( \frac{\partial Q}{P} \times \frac{\partial P}{P} = 1 \)

or, elasticity of price demand = Unitary elastic.

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