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PRICING OF MOBILE TELEPHONY SERVICES IN INDIA AFTER THE LAUNCH OF SERVICES BY RELIANCE JIO

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ABSTRACT
The mobile telephony service rates in India are one of the lowest in the World. The rate per minute of service usage has been continually moving downwards and has exhibited a free fall after the entry of Reliance Jio- a new service provider in the mobile telephony service space. This paper explores the rationale of sharp rate reduction, particularly if the cost of service production at the demands prevailing at these prices or changes in such costs partly or wholly justify the fall in service rates. Cost & Price relationship at gross and unit level and the price elasticity of demand have been used to establish that the intensity of competition in the sector is responsible for the sharp fall in prices, and these prices are not sustainable.
Keywords- Mobile Telephony Pricing, Competition, Costs, Price elasticity, RPM, ARPU.

1. INTRODUCTION

On 5th September 2016, Reliance Jio commercially launched its Wireless telephony services with an aggressively low penetration price causing massive disruption in the wireless telecom services sector. It started a price war for customer retention and corporate survival, defying all pricing logic. The overall service prices have exhibited a free fall during the period July'16 to Jun'20. The rate per minute of wireless telecom service usage dropped from INR 0.34 in the quarter ending June 2016 to an unbelievably low INR 0.12 in the quarter ending June 2020. Users responded by increasing Gross Minutes of Usage (GMOU) from 385 billion to 849 billion minutes/month and Minutes of Usage (per subscriber per month) from 371 to 744 minutes during this period, although the subscriber base increased only marginally from 1.035 billion to 1.141 billion. The reduction in subscribers' growth was partially due to the closure of several service providers due to financial issues emanating from abysmally low service rates in this period. In the period July'16 to June'20, the Average Revenue Per Use (ARPU) dropped from INR 125 to INR 90 per month, and the Adjusted Gross Revenue (AGR) for the sector dropped from INR 534 billion to INR 441 billion. Various operators could not survive and shut shop, while a few underwent merger or acquisition to pool up resources for survival.

The nature of the mobile telecom business in India is best described by the definition of hyper-competition given by **D'Aveni (1994)**. He defines hyper-competition as "an environment characterized by intense and rapid competitive moves in which competitors must move quickly to build advantages and erode the advantages of their rivals." D'Aveni has enlisted four driving forces causing hyper-competition in various sectors, including telecommunications. These driving forces are consumers expecting higher value for money, technology causing rapid changes, falling entry barriers, and the use of deep pockets. In India, the new competitor Reliance Jio has worked on all these four arenas viz: by changing price structure for creating the perception of better value for money amongst consumers, using the latest technology for reducing operational costs while maintaining quality, using various strategies including M& A to gain entry in the market and using its deep pockets to acquire customers for long term value creation while sacrificing on temporary gains.

Lakshminarayana & Ramchandra (2019) have referred to the theory of disruptive innovation propounded by **Christensen (1997)** in his book "Innovators' Dilemma" and stated that RJIO has engaged in disruptive innovation as it has created a new market and a new value network, thereby severely impacting the incumbent's service offerings. They state that RJIO's unique bundling of services with discounted data packs and free voice has genuinely changed the competitive scenario. Disruptive innovation in pricing adopted by RJIO led to its accelerated penetration in the market. It moved RJIO to the number one position both in terms of subscribers and revenue share within less than three and a quarter years of the commercial launch of services. It also forced various companies to exit the business or go for the M&A route for survival. As a result, the total number of

mobile telephony service operators has come down from 16 in March 2012 to 5 in March 2019, and the average number of operators offering mobile telephony services in a telecom circle has come down from 8.82 on March 12 to just 4 in the period March 2019 onwards.

Gruber and Verboven (2001) and **Valletti (2003)** have opined that the mobile telephony market resembles a natural oligopoly. Even the **Competition Commission of UK**, in 2003, had conceded that the mobile telecommunications sector has an inherently oligopolistic industry configuration, and effective competition is difficult to achieve. However, in India, the reduction in the number of operators has only increased the competitive intensity rather than reducing it- as reflected in continuously southward moving operational profits of operators.

Grzybowski & Karamti (2010) have studied competition in mobile telephony in France and Germany- both oligopolies and having regulated entry similar to India. **Autorité de la Concurrence (2005)** - the competition authority in France had found in Dec 2005 that Orange, SFR, and Bouygues were sharing sales data and termed it as collusive and anti-competitive behaviour although the service prices did not increase substantially in the period (1998-2002) under scrutiny and were comparable to Germany- a similar market. Grzybowski & Karamti have come up with explanations like the difference in the elasticity of demand for mobile services as well as the difference in customer behaviour about mobile phones being substitute or complement of fixed-line telephones- the fact remains that the end consumer continued to get good quality service in France during the period of supposed collusive behaviour by service providers. What is essential to understand is that all co-operation between competitors is not necessarily anti-competition or harmful for the customers. On the contrary, at times, such collaboration helps bring down costs. In the high capex mobile telephony industry, Airtel, Idea & Vodafone – three arch-competitors forming Indus Towers- a tower company to provide shareable towers is an ideal example in this regard.

One of the most widely used measures of competition is the price cost margin (PCM). This is based on the theory that in a genuinely competitive market, the service price will continuously move towards marginal costs. Although, there are theoretical treatises available in papers by various authors **(Rosenthal, 1980; Stiglitz, 1989; Bulow & Klemperer,1999; & Amir,2000)** wherein the increased intensity of competition does not necessarily reduce PCM. A few researchers **(Graddy,1995; Genesove & Mullin,1998; & Wolfram,1999)** advocate using elasticity adjusted PCM yielding the conduct parameter, which is a measure of competition. **Cowling & Waterson (1976)** proved that HHI is proportional to the Lerner Index (PCM) for Symmetric Cournot Model and establishing that competitive intensity is less in more concentrated markets.

In this paper, we will try to establish that it is the intensity of competition, which was very high despite the number of competitors dropping to four only and that the same has been governing the puzzling drop in the price of mobile telephony service in India during the period July'16 to June'20.

2. DATA & METHODOLOGY

The industry-level data for telecom revenue, rates, and customer base have been tabulated from various Quarterly Telecom Services Performance Report published by TRAI. The financial data of operators- Airtel, Vodafone-Idea, and Reliance Jio has been taken from their respective websites and published quarterly financials.

The significant determinants of a service's price are service production cost, service demand at a particular price, government regulations, and competitor pricing. During the period of study, the government regulations regarding telecom services did not change. It will be shown that cost considerations neither governed the price change nor necessitated after considering the price elasticity of demand to maximize profit or revenue. Accordingly, by eliminating the primary three reasons, it will be inferred that it was the competition and tendency of incumbents to imitate and copy the pricing offered by the new entrant - a pricing strategy adopted by the incumbent operators which resulted in free fall in prices. More specifically, we will try to establish the following:

(i) the costs (or quarterly change in costs) do not correlate with the prices (or quarterly change in prices) during July 2016 to June 2020, and

(ii) the price elasticity of demand is such that reduction in service rates yields not just in profit reduction but also reduction of the gross revenue of operators.

Unfortunately, the operator financials are complicated- because of frequent mergers and acquisitions and because the segmental profit & loss statements are often not available. Further, some of the companies closed down in between, and hence their financials do not cover the entire period of analysis. Further, all the service provider companies are not listed on stock exchanges, and hence their detailed financials are not in the public domain. Multinational operators like Vodafone, Telenor, and Sistema publish limited country-wise segment-wise details, and the specifics are lost in the consolidated financials. Hence, Airtel has been chosen as a representative operator to establish various hypotheses on pricing. Further, Airtel has the best financial performance track record amongst incumbent operators- hence in case reduction of rates is not justified in its case, it automatically becomes even more unreasonable in the case of BSNL, MTNL Vodafone Idea.

Additionally, the PCM has been calculated and shown to prove that the competitive intensity is high, and the current prices are not sustainable in the long run.

The cost in this analysis means the sum of operational cost, cost of invested capital considering a relevant Weighted Average Cost of Capital (WACC), and depreciation & amortization for the period. After considering the 10-year Indian Government Bond rate, academic estimated risk-free rate and international country risk premium – Parsons & Ramsey (2001) arrived at low, medium, and high WACC of 14.97%, 19.07%, and 25.24% per annum, respectively for the Indian telecom industry, which has been considered in this paper.

3. ANALYSIS & RESULTS

3.1 CPM & RPM Relationship: The Revenue & Costs for Airtel extracted from their quarterly financials (Ref: Table 1) as well as Cost per Minute (CPM) & Revenue per Minute (RPM) at different WACC are enumerated in Table 2.

To start with, the difference between CPM (cost of service per minute) and RPM was examined. Let CPM-RPM = Θ

To comment on the difference between the RPM & CPM during the period July 2016 to June 2020, and to prove that Θ > k, it was tried to find out maximum values of k, at which the following null hypothesis is rejected: Null Hypothesis: Θ=k; Alternate Hypothesis: Θ > k

We use t_{15} (0.05) = 1.75305, and the values of k computed are tabulated in Table 3.

Table 1: Basic Financial Data of Bharti Airtel Ltd. from QE Jun'13 to QE Jun'20.

Quarter ending	Subscribers (In Mn)	Revenue (Rs. Mn)	EBITDA (Rs. Mn)	EBIT (Rs. Mn)	Capex (Rs. Mn)	Cumulative Investment (Rs. Mn)	ARPU (Rs/Sub/Month)	MOU (Bn Min)
Jun-20	279.869	128771	52227	1650	34415	2392875	157	834.57
Mar-20	283.667	129529	50796	265	95207	2370194	154	821.22
Dec-19	283.036	111653	40109	-8249	40823	2350313	135	762.50
Sep-19	279.430	109814	39913	-11449	27469	2392024	128	710.87
Jun-19	276.817	108667	38742	-12419	43223	2334818	129	737.44
Mar-19	282.640	106322	25657	-13778	41075	2319107	123	727.52
Dec-18	284.224	101894	19498	-19032	53091	2266463	104	619.04
Sep-18	332.764	102521	21468	-15919	69036	2226885	100	684.83
Jun-18	344.564	104803	27603	-8782	78664	2170373	105	723.58
Mar-18	304.192	103532	29428	-4820	46233	2051570	116	611.43
Dec-17	290.113	107510	35091	1668	59601	2027872	123	500.44
Sep-17	282.047	122450	42087	11378	71440	1983494	145	438.30
Jun-17	280.647	129147	44281	12603	62513	1905161	154	426.86
Mar-17	273.648	129718	47873	14392	28497	1864560	158	386.66
Dec-16	265.853	138130	52986	23023	53714	1845896	172	334.18
Sep-16	259.941	147243	62775	33398	45804	1651117	188	316.61
Jun-16	255.735	150420	64099	34672	41217	1595088	196	317.62

Source: Bharti Airtel Website: https://www.airtel.in/about-bharti/equity/results

The published quarterly Financials have been used to derive the following (as tabulated in table 2) :

(i) Operational Costs= Revenue-EBITDA

(ii) Depreciation & Amortization= EBITDA-EBIT

(iii) Total Costs = Operational Costs + Dep. & Amortization+ Finance Cost Finance Cost (For the Quarter) = Cumulative Investment till Quarter end X WACC (% per annum) / 4

(iv) Cost Per Minute (CPM) = Total Costs /MOU

(v) Rate Per Minute (RPM) = Revenue/MOU

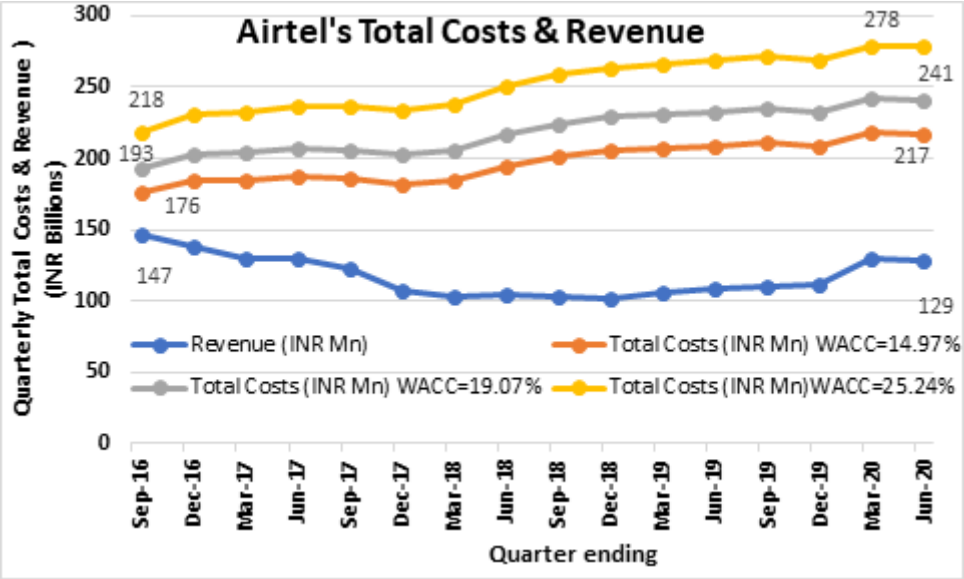

Fig. 1: Airtel's total revenue and total costs at different values of WACC

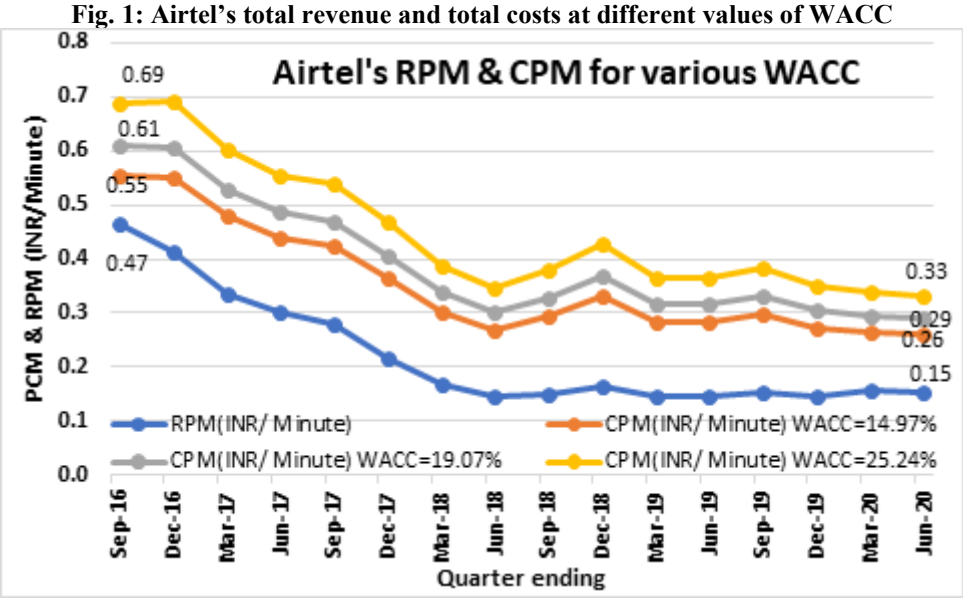

Fig. 2: Airtel's RPM and CPM at different values of WACC

This implies that our t-test rejects the following null hypothesis at 5% level of significance-

Null Hypothesis 1. H_0: During the period July 2016 to June 2020, the difference between the cost per minute of the Operators incurred by them in generating the minutes of usage provided to its customers and the Rate per Minute for the corresponding quarter was equal to x. (x=12.455 paise, 16.221 paise, and 21.665 paise for the weighted average cost of capital being 14.97%, 19.07%, and 25.24% respectively).

Alternative Hypothesis 1. H_1: From July 2016 to June 2020, the cost per minute of the Operators in generating the minutes of usage provided to its customers was higher than the Rate Per Minute for the corresponding Quarter minimum by 'x.'

(x=12.455 paise, 16.221 paise, and 21.665 paise for the weighted average cost of capital being 14.97%, 19.07%, and 25.24% respectively). In fact, for us to say with 95% confidence level that the RPM & CPM were equal, the weighted average cost of capital should be 2.9729%, which is irrationally low for a country where the ten years Govt. Bond Interest rate was in the range of 5.76% to 8.18%. The consistency in the CPM being higher than RPM during the complete period is visible in Fig. 2

Table 2: Quarterly Costs and CPM (Rs/Min) of Airtel at different WACC

Quarter ending	Operational costs	Dep. & Amort.	Finance costs (Rs. Mn) at WACC			Total costs (Rs. Mn) at WACC			CPM (Rs./Min) at WACC			RPM
			25.24%	19.07%	14.97%	25.24%	19.07%	14.97%	25.24%	19.07%	14.97%	(Rs./Min)

Jun-16	86321	29427	100650	76046	59696	216398	191794	175444	0.6813	0.6038	0.5524	0.4736
Sep-16	84468	29377	104185	78717	61793	218030	192562	175638	0.6886	0.6082	0.5547	0.4651
Dec-16	85144	29963	116476	88003	69083	231583	203110	184190	0.693	0.6078	0.5512	0.4133
Mar-17	81845	33481	117654	88893	69781	232980	204219	185107	0.6025	0.5282	0.4787	0.3355
Jun-17	84866	31678	120216	90829	71301	236760	207373	187845	0.5546	0.4858	0.4401	0.3025
Sep-17	80363	30709	125158	94563	74232	236230	205635	185304	0.539	0.4692	0.4228	0.2794
Dec-17	72419	33423	127959	96679	75893	233801	202521	181735	0.4672	0.4047	0.3631	0.2148
Mar-18	74104	34248	129454	97809	76780	237806	206161	185132	0.3889	0.3372	0.3028	0.1693
Jun-18	77200	36385	136951	103473	81226	250536	217058	194811	0.3462	0.3	0.2692	0.1448
Sep-18	81053	37387	140516	106167	83341	258956	224607	201781	0.3781	0.328	0.2946	0.1497
Dec-18	82396	38530	143014	108054	84822	263940	228980	205748	0.4264	0.3699	0.3324	0.1646
Mar-19	80665	39435	146336	110563	86793	266436	230663	206893	0.3662	0.3171	0.2844	0.1461
Jun-19	69925	51161	147327	111312	87381	268413	232398	208467	0.364	0.3151	0.2827	0.1474
Sep-19	69901	51362	150937	114040	89521	272200	235303	210784	0.3829	0.331	0.2965	0.1545
Dec-19	71544	48358	148305	112051	87960	268207	231953	207862	0.3517	0.3042	0.2726	0.1464
Mar-20	78733	50531	149559	112999	88705	278823	242263	217969	0.3395	0.295	0.2654	0.1577
Jun-20	76544	50577	150990	114080	89553	278111	241201	216674	0.3332	0.289	0.2596	0.1543

Table 3: Amount by which CPM exceeds RPM (in Paise per minute) at different WACC

WACC	$\Theta_{average}$	s^2	s	k value
14.97%	13.2835	3.5735	1.8904	12.455
19.07%	17.1544	4.54	2.1307	16.2206
25.24%	22.9797	9	3	21.6648
2.97%	1.7145	15.3038	3.912	0

.The CPM & RPM, as well as changes in CPM & Changes in RPM, are strongly correlated, but since the revenue is significantly lagging, the Costs and the slope of the CPM-RPM relationship is less than unity for WACC=25.24% as well as WACC= 19.07% case and barely above unity in WACC=14.97% case, hence with increasing MOUs, the gap between overall costs and revenues is seen as increasing. (Fig. 1). It is also worth noting that while the change in RPM also appears to have a relationship with change in CPM, the strength of the linear relationship (Fig. 3) is relatively weak with the coefficient of determination in the range of 0.44 0.60. With less than unity slope in the graphs- the trend during this period does not show fixation of prices to enable the gap between overall costs and overall revenue to reduce.

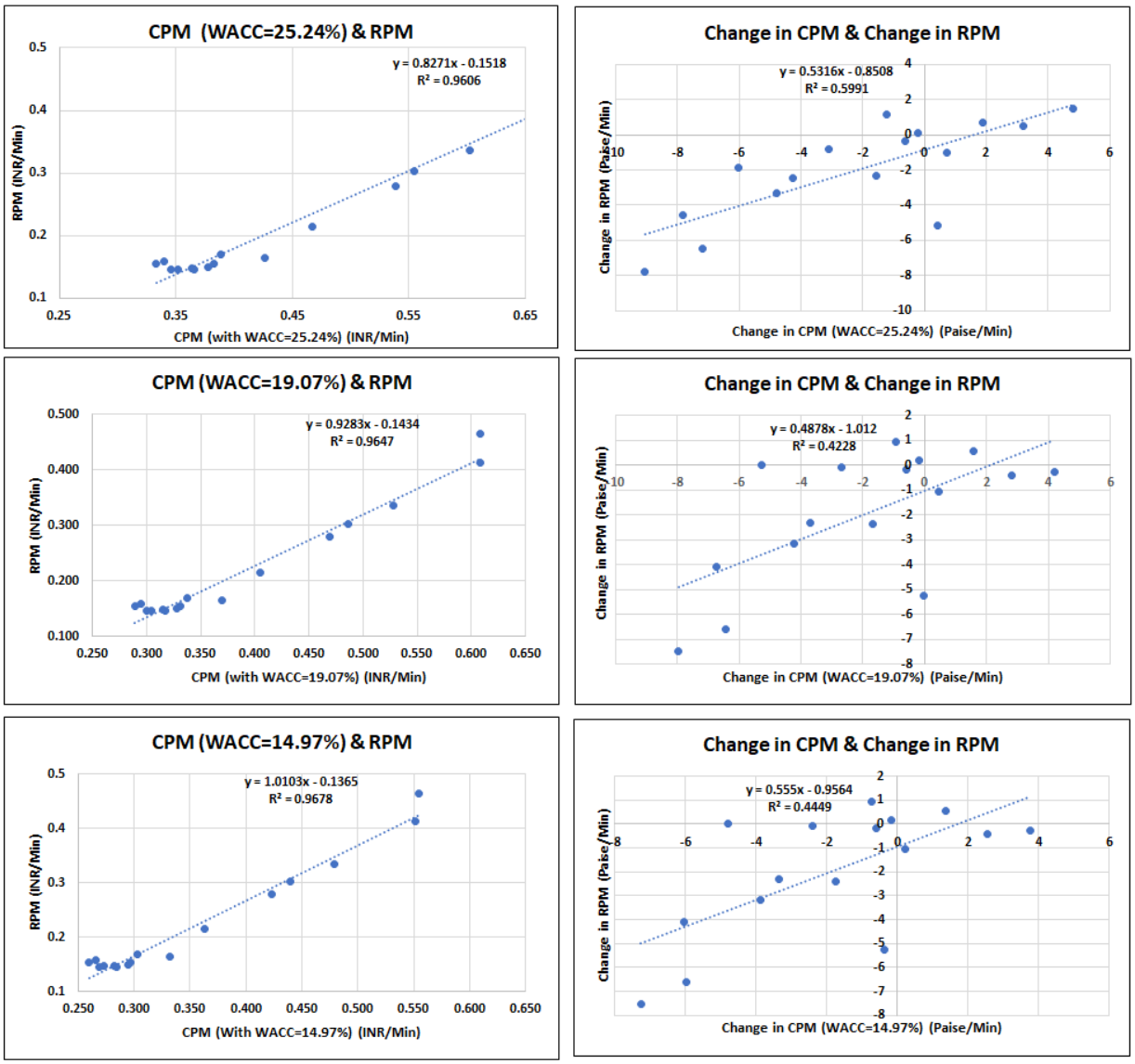

Fig 3: Relationship between CPM & RPM and change in CPM & Change in RPM.

3.2. Gross Costs & Gross Revenue: To confirm the diversity in trends of cost movement and price movement at a gross level, hypotheses 2 and 3 hereunder are tested.

Null Hypothesis 2. H_0: During the period July 2016 to July 2020, the Gross revenue is not impacted by the Gross costs incurred by the operator in generating the aggregate minutes of usage it provided to its customers.

Alternative Hypothesis 2. H_1: During the period July 2016 to July 2020, the Gross revenue is significantly impacted by the Gross costs incurred by the operator in generating the aggregate minutes of usage it provided to its customers.

The Null Hypothesis, if accepted, shall imply that the cost considerations did not significantly impact the pricing decisions leading to the revenues, which were independent of actual costs incurred.

If we consider a simple linear relation – $R = \beta_1 C + \beta_0$

Where R= Quarterly revenue (INR): C= Quarterly costs (INR)

β_1 & β_0 are slope and intercept, respectively. Then the hypothesis mentioned above translates to

Null Hypothesis 2. H_0: $\beta_1 = 0$

Alternate Hypothesis 2. H_1: $\beta_1 \neq 0$

Additionally, the following hypotheses were tested-

Null Hypothesis 3. H_0: During the period July 2016 to July 2020, the quarterly change in Gross revenue is not impacted by the change in Gross costs incurred by the operator in generating the aggregate minutes of usage it provided to its customers in the corresponding quarter.

Alternative Hypothesis 3.H_1: During the period July 2016 to July 2020, the quarterly change in Gross revenue is significantly impacted by the change in Gross costs incurred by the operator in generating the aggregate minutes of usage it provided to its customers in the corresponding quarter.

Since Airtel is a surviving operator and its profitability is known to be the best amongst incumbents, the null hypotheses, if found to be true for Airtel during this period, shall be even more applicable to other incumbents who either closed down due to huge deficit or had to undergo merger as a step towards readiness for prolonged financial hardship due to the price war. For the testing of hypotheses 2 and 3 at a significance level of 5%. We have a degree of freedom of 14, which gives Upper $t_{critical}$ = 2.50957 and lower $t_{critical}$ = -2.50957. The results are tabulated in Table 4. Since, in all these cases, p-value > significance level, $t_{cal} > t_{\alpha/2, n-2}$ and $F_o < f_{0.05, 1, 14}$ – we accept the null hypothesis and reject the alternate hypothesis. Accordingly, it is established that neither the quarterly changes in costs had any significant impact on quarterly changes in revenue nor the overall costs played any role in overall revenue determination. During this period, the prices of services were fixed based on competitive pressures and survival strategy to retain existing customers and avoid them moving to the new entrant who was aggressively pricing to attract new subscribers. All the operators (excluding Reliance Jio) exhibited abysmal operating margin during this period (Fig.5). It is also noted that Baumol's (1958) profitability threshold is negative in the case of Indian mobile telephony operators.

Table 4: Various parameters for testing of Hypotheses 2 & 3

		Quarterly Cost & Revenue				Quarterly changes in Cost & Revenue		
t-test	**WACC**	**25.24%**	**19.07%**	**14.97%**		**25.24%**	**19.07%**	**14.97%**
	Sample mean	252050.88	219125.5	197246.25		3857.06	3087.94	2576.88
	Sample std. deviation	19474.95	15995.63	13720.23		5152.62	4649.27	4362.92
	Standard error	13555.85	13834.96	14070.87		7122.99	6898.89	6690.98
	Test Statistic t_{cal}	-2.2703×10^{-5}	-2.4245×10^{-5}	-2.4648×10^{-5}		5.7×10^{-5}	8.4×10^{-5}	0.00011
	2-tail p-value	0.99998	0.999981	0.999981		0.99996	0.99993	0.99992
F-test	**F_0**	2.9323	2.256	1.7155		1.2938	2.303	3.3324
	p-value	0.1089	0.1553	0.2114		0.2744	0.1513	0.0893

Fuss & Waverman (1981) derived the condition for sustainability of price against inefficient entry. They stated that prices are sustainable only if they cover minimum industry costs at the service demand at those prices. In the Indian wireless telecom industry, it is clear that the prices are significantly lower than the costs for demands at those price levels. Accordingly, the current price level is not sustainable for the industry.

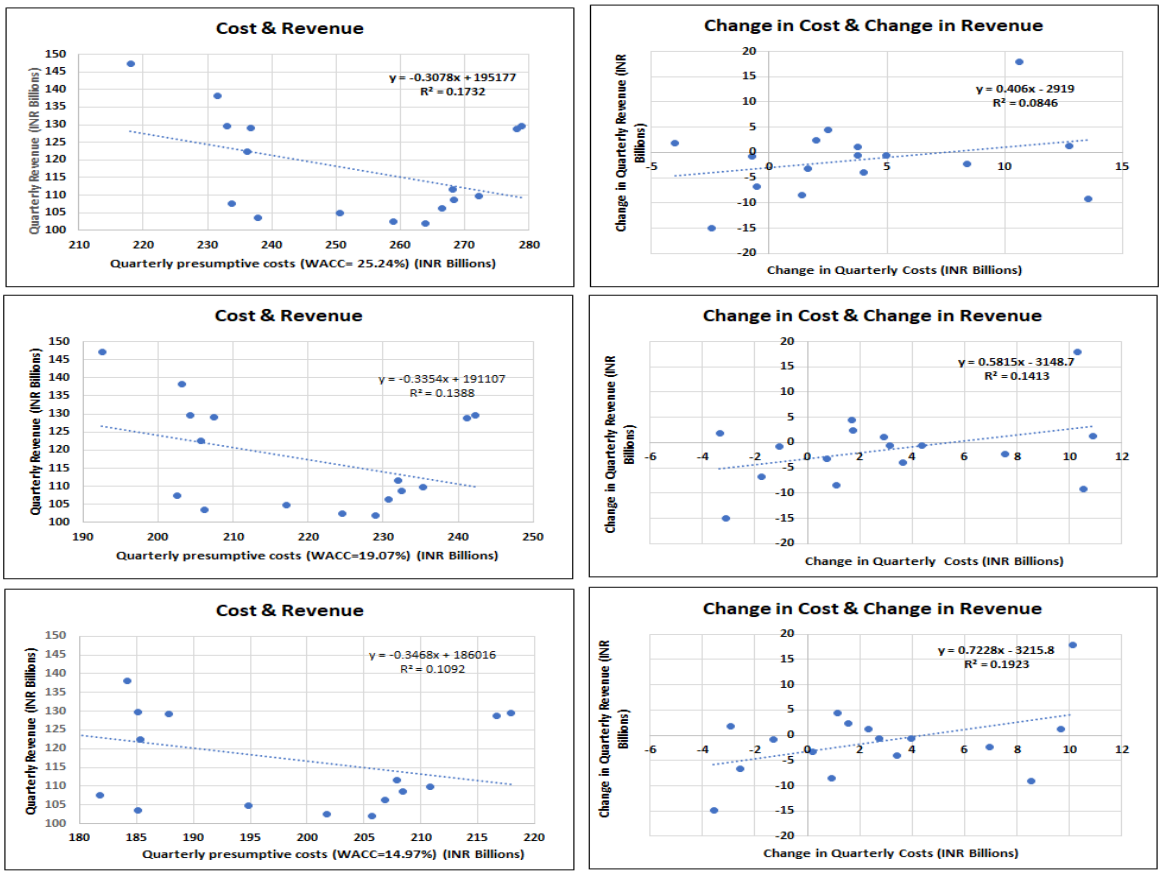

Fig. 4: Insignificant dependency of Revenue and Quarterly Change in Revenue on Costs and Quarterly changes in Costs respectively.

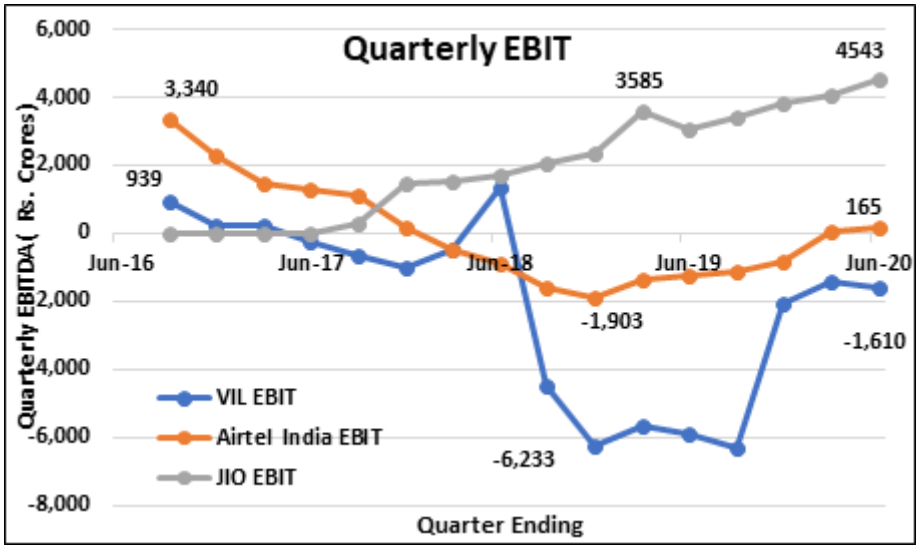

Fig. 5. Quarterly EBIT of operators. Source: Company Financials for Airtel & RJIO, www.moneycontrol.com for Vodafone Idea Ltd. financials.

Note: Airtel EBIT mentioned is only for Mobile Services India.

3.3. Operating Profits: The EBIT graph in Fig. 5 shows declining EBIT of incumbents till Dec'18- Sep'19. Reductions in rates at the EBIT shown (often negative) cannot be made except for strategic reasons. In this case, it was customer retention and matching the service rates with the new entrant rates. It may be noted that the PCM has been moving adversely for the incumbent operators despite the overall number of operators coming down to four only.

4. PRICE ELASTICITY OF MOBILE TELEPHONY SERVICE PRICING IN INDIA

Shankar & Morya (2020) have calculated the price elasticity of mobile telephony demand in India. It is found that depending on the demand expression (quadratic polynomial or exponential) and the demand parameter considered (Gross MOU or Per capita MOU), the elasticity was in the range of 0.890 to 1.515 in June'16. However, it has come down to the range of 0.375 to 0.571 in June'20. It is noted that the costs are continually higher than revenue during this period. Accordingly, except for long term strategic reasons, it did not make economic sense to reduce rates, particularly after the elasticity values became sub-unity, i.e., after March'17, when the price elasticity of demand had fallen to the range of 0.578 to 0.949.

It is apparent that service providers do not have any immediate incentive in lowering the prices anymore, and the price war between the competing service providers is to retain the customers in the long run. The situation is somewhat like the e-commerce business in India a few years back. One explanation is that because of the large size of the Indian mobile telephony market and interest by prominent global players like AT&T, Singtel, NTT, Softbank, the service providers are driven by Company valuation and creation of shareholder value rather than EBIDTA or short-term profits. Incidentally, valuation in a few recent M & A transactions, including the Hutchison-Vodafone deal and Spice acquisition by Idea, is reported to have been impacted more by lifetime subscriber value than EBIDTA multiples or returns on capital employed.

5. RESEARCH SIGNIFICANCE

This research indicates that various mobile telephony service providers have been following survival strategies with effect from July 2016 onwards under intense competition. Since the current service pricing of mobile telephony in India is below marginal costs of service and has been proved to be unsustainable – it is recommended that the Government of India may intervene positively in this regulated industry to avoid the sudden collapse of production of these services. Additionally, since the price elasticity of demand at current rates implies that at present tariff levels, any further decrease in prices will lead to a reduction in total revenue- any such act by any operator can be considered as resorting to predatory pricing. Together with the price elasticity study, the inputs from this paper can be used to design an attractive tariff plan. Quantitative analysis in this research can facilitate positive intervention from the Government in pricing mobile telephony services, thereby increasing consumer welfare or accelerating mobile telephony penetration in India.

6. LIMITATIONS OF THIS STUDY AND SCOPE OF FURTHER RESEARCH

The impact of the interplay and convergence of services like cable tv, gaming, fixed-line telephony, broadband internet services, and mobile telephony on consumer behaviour, service demand, and on costs and pricing (through bundled service offerings) has not been considered in this study, and mobile telephony has been considered as an isolated service. Further, as a progression to this study, the purchasing capacity of Indian

consumers or determination of their threshold budget for mobile telephony can be determined and effectively used by operators to design an optimal price structure for the mobile telephony services in India.

7. CONCLUSION

From July'16 to June'20, subscriber retention and growth are not aligned with the changes in telecom revenue. Cost & Revenue gap, cost being higher has either continued or increased. It has already led to several operators either shutting down business or getting amalgamated with others. By eliminating all other factors impacting the price, this paper tries to establish that it is, to a large extent, the competitive pressure and irrational imitation of new entrant operator's prices that has led to incumbents making huge losses. Since such pricing is not viable for long periods, strategic interventions to modify service pricing and value offers are imminent. The regulatory body may also proactively intervene to ensure continuous growth both in terms of subscribers & revenue, and avoidance of predatory pricing, and consequent creation of a monopoly.

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