A graphical presentation on the outcome of Spectrum Auction -21.

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Introduction: -

The auction of multiple frequency bands was conducted by Department of Telecom in March, 2021. The auction was completed within 2 days and was ended after completing 6 clock rounds. A report has been prepared on the basis of the data published by DoT in the public domain. The purpose of this report is to give an account of the auction from the perspective of WPC Wing, the spectrum managing body. This report portrays the result of auction quantitatively with the help of charts and plots to give a simplified visual description.

The following table (Table -1) gives the overall view of the auction results for all the bands. Seven different bands were put on sale in the online auction in different service areas using the Simultaneous Multiple Rounds Ascending (SMRA) e-auction algorithm. The key indicators of the auction for each band can be seen in the below given table. Across the different service areas, the 700 MHz band offered the highest quantum whereas the 900 MHz offered the lowest. The 700 MHz band was available in each LSA uniformly (6 blocks) while for the rest of the bands the quantum of spectrum varied from LSA to LSA.

Band	Block Size (MHz)	No of LSA where spectrum was offered.	No of LSA where spectrum was sold.	No of Total Blocks offered.	No of Total Blocks sold.	Total spectrum Offered (MHz).	Total Spectrum Purchased (MHz).	Reserve Price Aggregated over all LSA (In Rs Crores).	Revenue Collected aggregated over all LSA (In Rs Crores).	Revenue in percentage terms, Bandwise. (%).
A	B	C	D	E	F	G	H	I	J	J*100/I
700 MHz	5	22	0	132	0	660	0	197430	0	0
800 MHz	1.25	22	19	184	120	230	150	54685	37500	68.57
900 MHz	0.2	19	7	494	192	98.8	38.4	22322.6	7722.4	34.59
1800 MHz	0.2	22	21	1775	761	355	152.2	56673.6	18997.4	33.52
2100 MHz	5	19	3	35	3	175	15	28585	355	1.24
2300 MHz	10	22	22	56	50	560	500	20340	13240	65.09
2500 MHz	10	12	0	23	0	230	0	20360	0	0
Total		**138**	**72**	**2699**	**1126**	**2308.8**	**855.6**	**400396.2**	**77814.8**	**19.43**

Table - 1

The outcome of auction showed that there was no demand for the spectrum in the 700 MHz and 2500 MHz bands as can be seen in columns D and F in the table. The 2100 MHz band was sold only in 3 LSA though offered in 19 LSA. There was moderate demand for 900 MHz and 1800 MHz bands spectrum. The highest demand was for the 800 MHz and 2300 MHz bands. As for the revenue earned, similar trends as in the variability of quantum of spectrum sold were observed across the bands. The highest revenue was earned in the 800 MHz band sale and the lowest in 2100 MHz band if we foregoes the unsold bands 700 MHz and 2500 MHz The overall reserve price estimated for all the bands aggregated to just above Rs.4 Lakh Crores. The revenue collected is Rs. 77,814 Crores which is 19 percent of the anticipated receipts.

Keeping the above table as the base precinct, the following questions will be answered in this report with the help of various plots:

1. What are the reserve prices and the quantum of spectrum offered for different bands for each LSA?
2. What is the percentage of spectrum bought by each of the three operators in different bands for each LSA?
3. How many spectrum blocks were sold against that were offered in each of the LSA in different bands?

4. How much revenue was collected in different bands in each LSA and overall across India?

5. What alternatives can be suggested with regard to the viability of selling 700 MHz spectrum?

1. Bands ,blocks and RP of offering:

(i) 800 MHz

The block size of 800 MHz was kept at 1.25 MHz (paired). The availability of spectrum varied from 2 to 12 blocks from LSA to LSA. Out of 22 LSA, spectrum was sold in 19 LSA. The highest number of blocks sold was 10, in Maharashtra LSA. The highest revenue was received from Maharashtra LSA. The two plots below (fig 1) shows the spectrum details offered and spectrum sold in each LSA respectively.

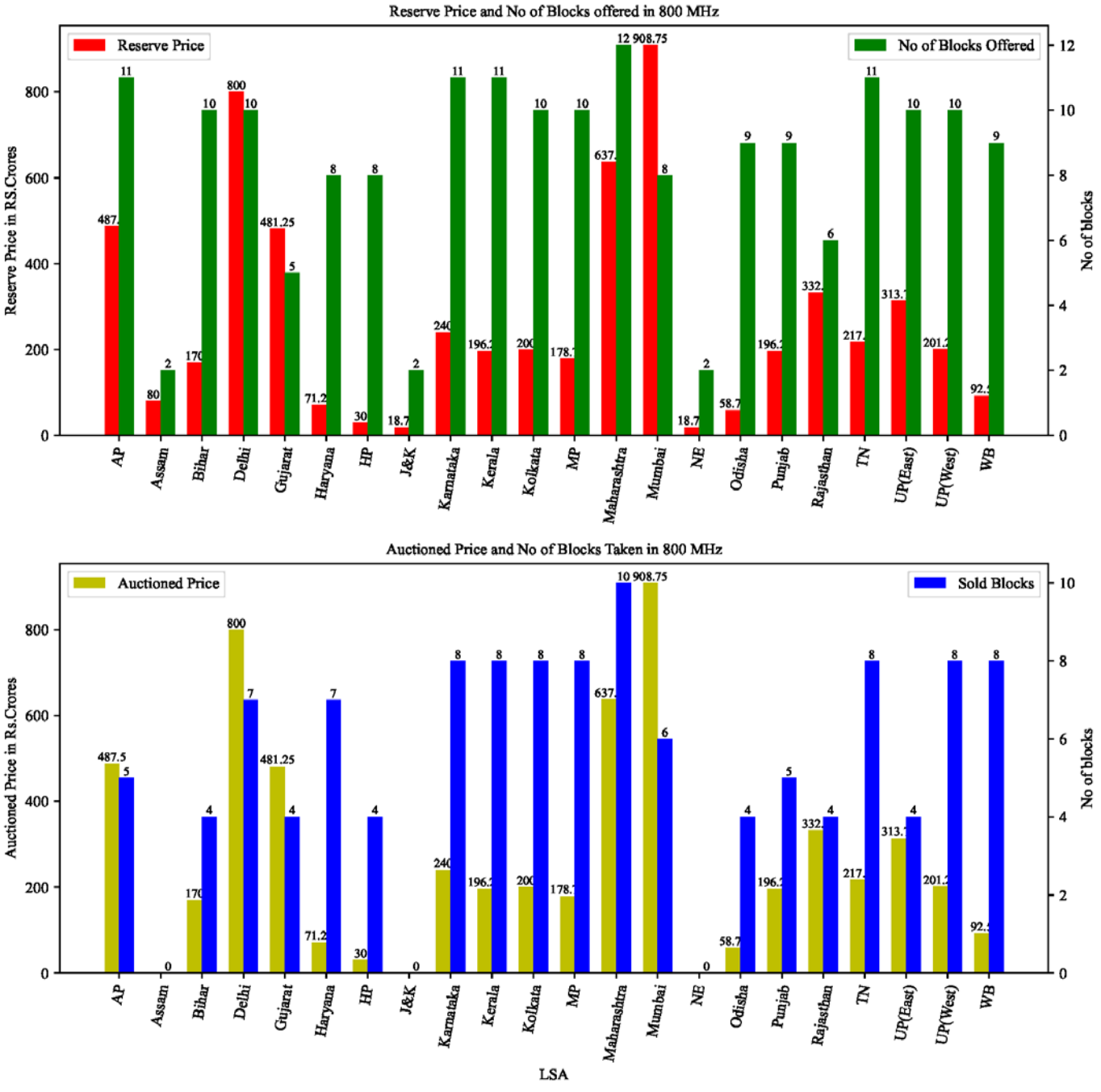

Fig 1

(ii) 900 MHz:

The block size of 900 MHz was kept at 0.2 MHz (paired). The availability of spectrum varied from 0 to 88 blocks from LSA to LSA. Out of 19 LSA where spectrum was offered, it was sold only in 9 LSA. The highest number of blocks sold was 50, in Tamilnadu LSA. The highest revenue was received from Tamilnadu LSA. The plots below (fig 2) shows the spectrum details offered and spectrum sold in each LSA respectively.

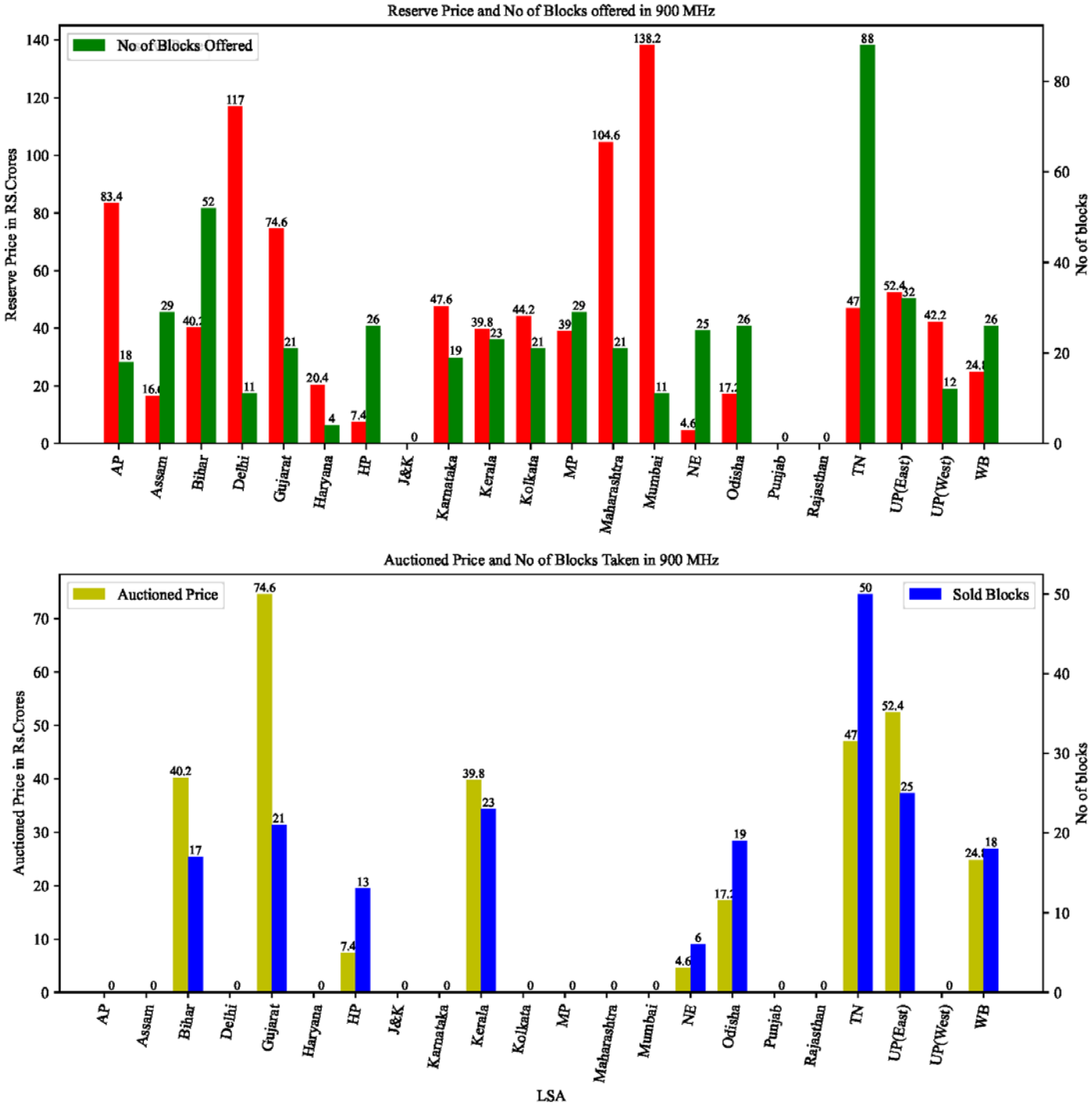

Fig 2

(iii) 1800 MHz:

The block size of 1800 MHz was kept at 0.20 MHz (paired). The availability of spectrum varied from 19 to 124 blocks from LSA to LSA. Out of 22 LSA, spectrum was sold in 21 LSA. The highest number of blocks sold was 101, in Karnataka LSA. The highest revenue was also received from Karnataka LSA. The plots below (fig 3) shows the spectrum details offered and spectrum sold in each LSA respectively.

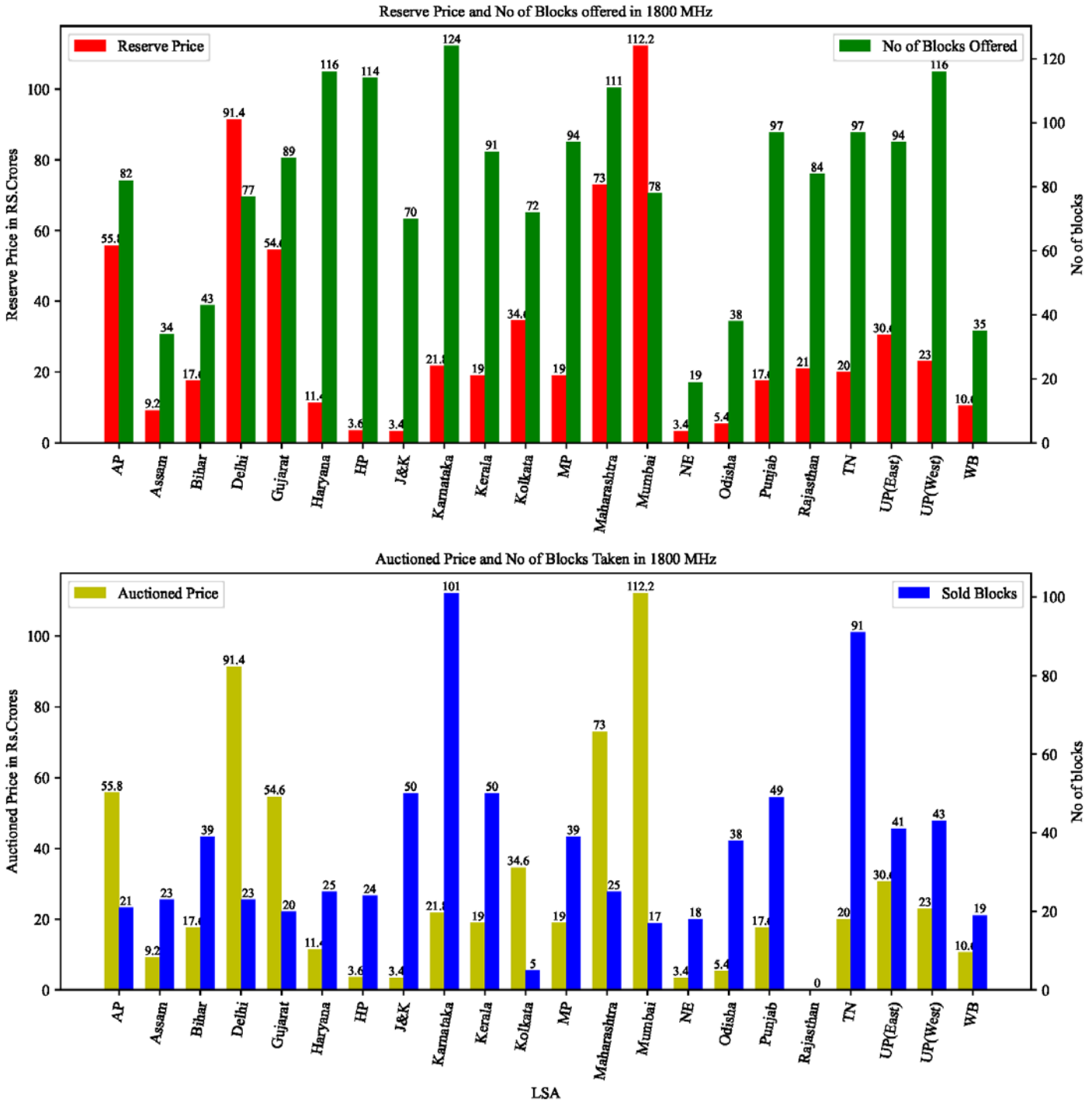

Fig 3

(iv) 2100 MHz: -

The block size of 2100 MHz was kept at 5 MHz (paired). The availability of spectrum varied from 0 to 3 blocks from LSA to LSA. Out of 19 LSA in which spectrum was offered, it was sold only in 3 LSA. One block each was sold in Assam, North East and West Bengal. The highest revenue was received from WB LSA. The plots below (fig 4) shows the spectrum details offered and spectrum sold in each LSA respectively.

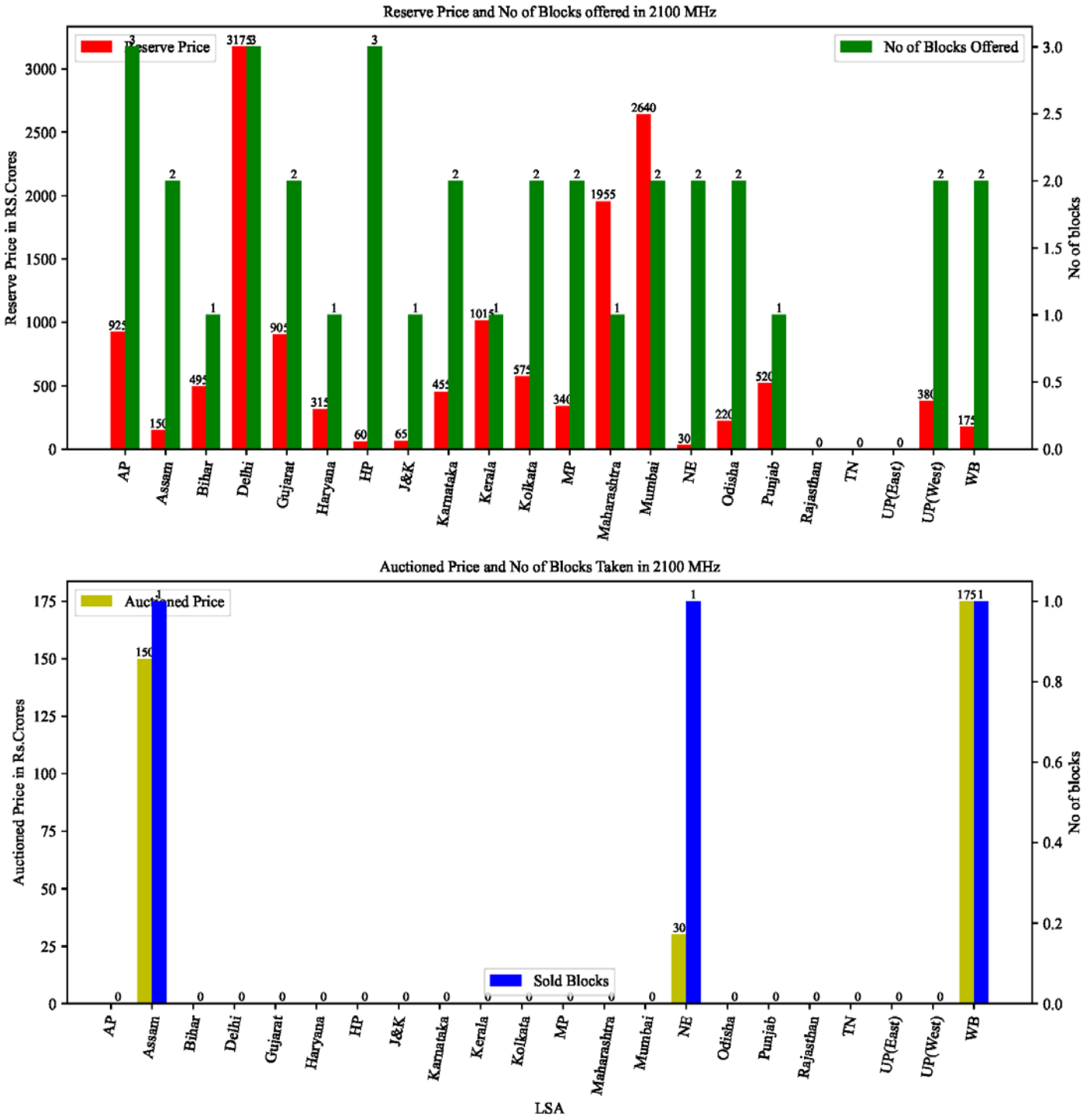

Fig 4

(v) 2300 MHz: -The block size of 2300 MHz was kept at 10 MHz (unpaired). The availability of spectrum varied from 2 to 4 blocks from LSA to LSA. Out of 22 LSA, spectrum was sold in 21 LSA. Four blocks that was offered in 6 blocks were sold off, in all 6 LSA. The highest revenue was received from Mumbai and Delhi where one block out of two offered was taken. The plots below (fig 5) shows the spectrum details offered and spectrum sold in each LSA respectively.

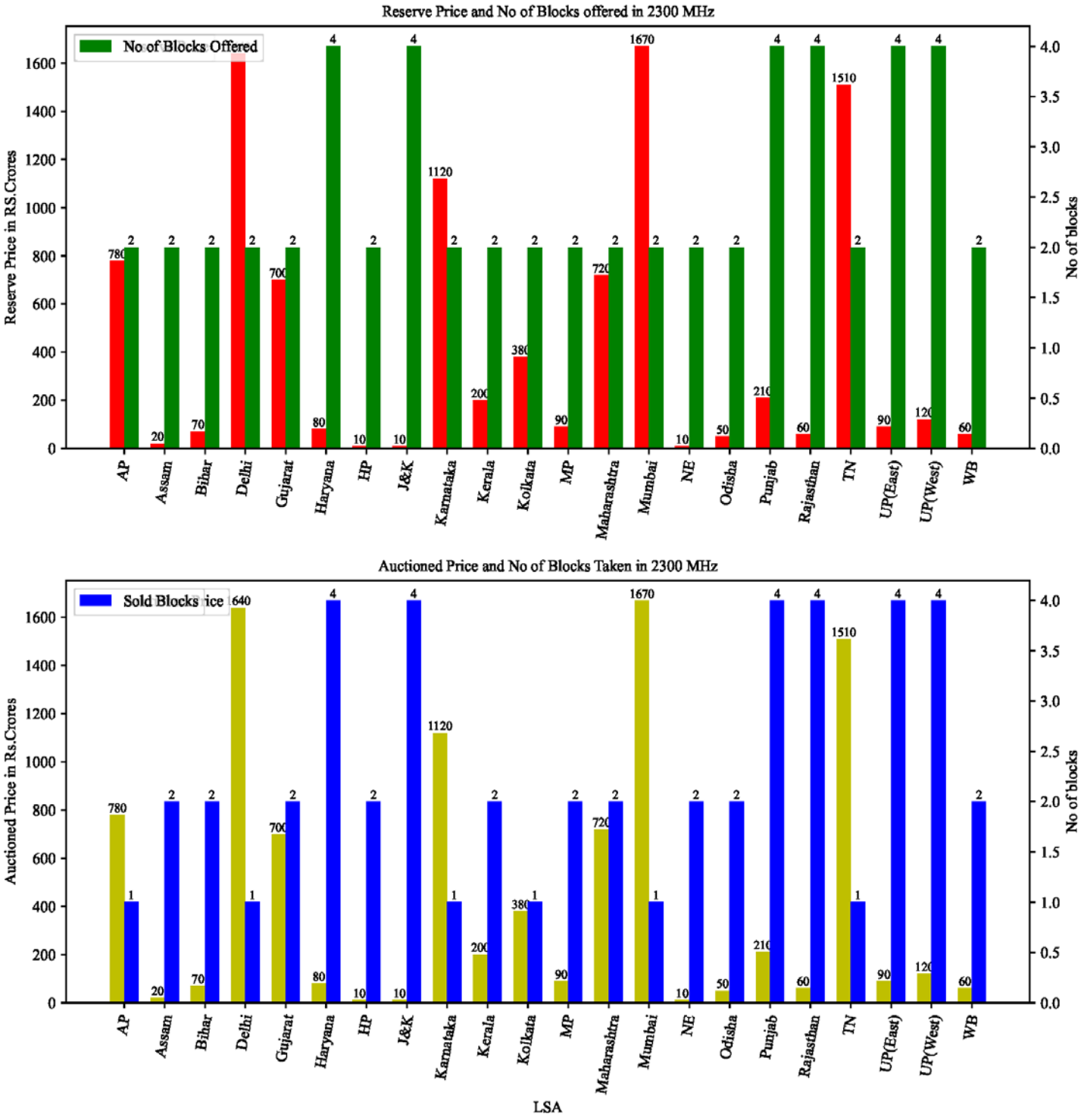

Fig 5

(vi) 2500 MHz:

The block size of 2500 MHz was kept at 10 MHz (paired). The availability of spectrum varied from 1 to 4 blocks from LSA to LSA. Out of 12 LSA where spectrum was offered, it was not sold in any of them. The situation is similar to 700 MHz. The plots below (fig 6) shows the spectrum details offered and spectrum sold in each LSA respectively.

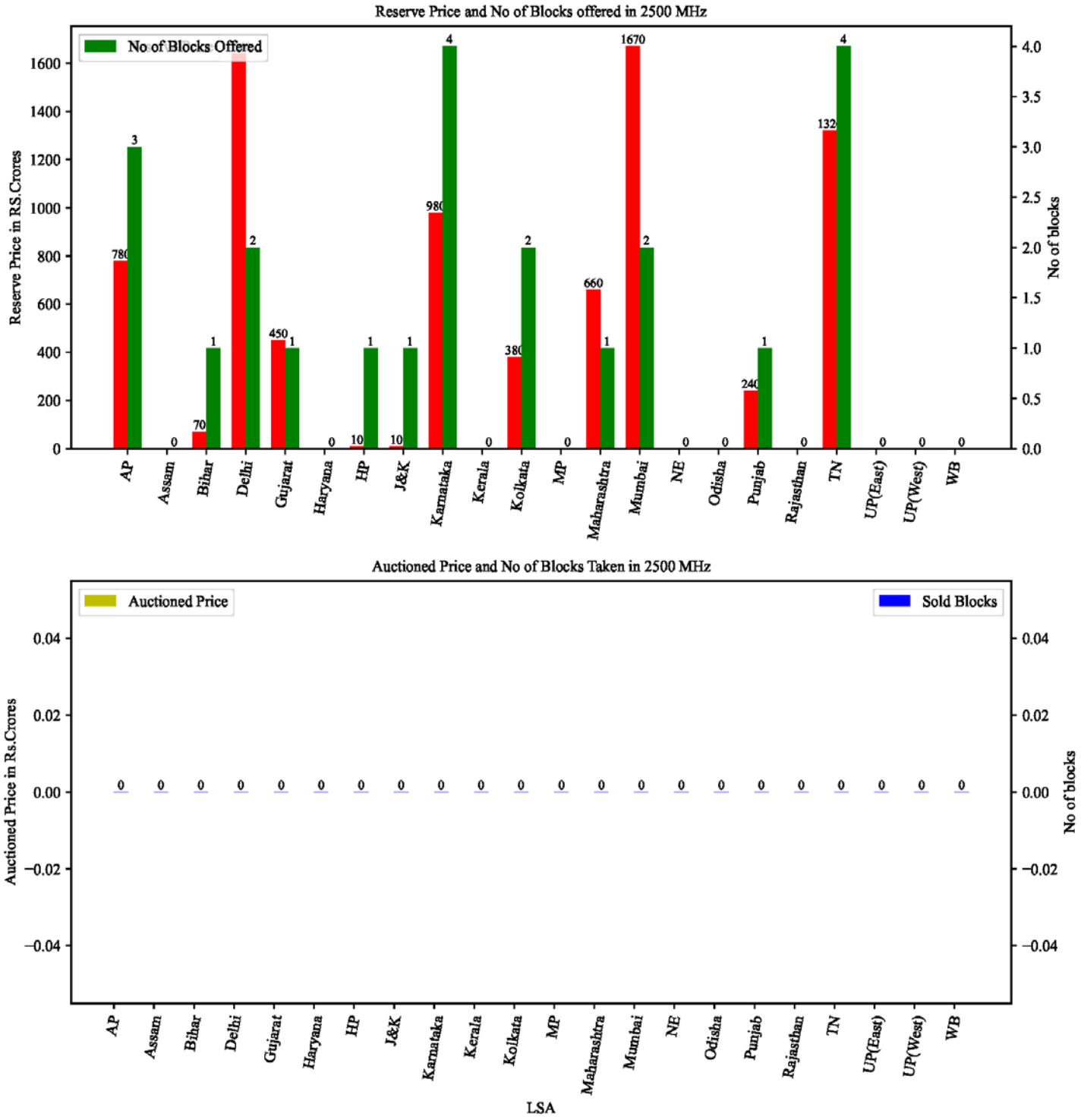

Fig 6

2. A comparison on the spectrum bought by the telecom service providers in terms of percentages:

(i) 800 MHz: - Two operators, namely M/s Bharti Airtel Ltd (referred to as Bharati ahead) and M/s Reliance Jio Infocomm (referred to as Jio) bought 800 MHz spectrum. The former bought spectrum in 4 LSA and the latter in all LSA. In percentage terms, WB topped the list with 89% of the available spectrum was sold. The lowest is in Bihar and UP (East) where only 40 % was sold from the available spectrum. The plots below (fig 7 and fig 8) show the total percentage of spectrum sold in each LSA in vertical stacked bar chart and vertical grouped bar chart respectively depicting the two operators sharing the band.

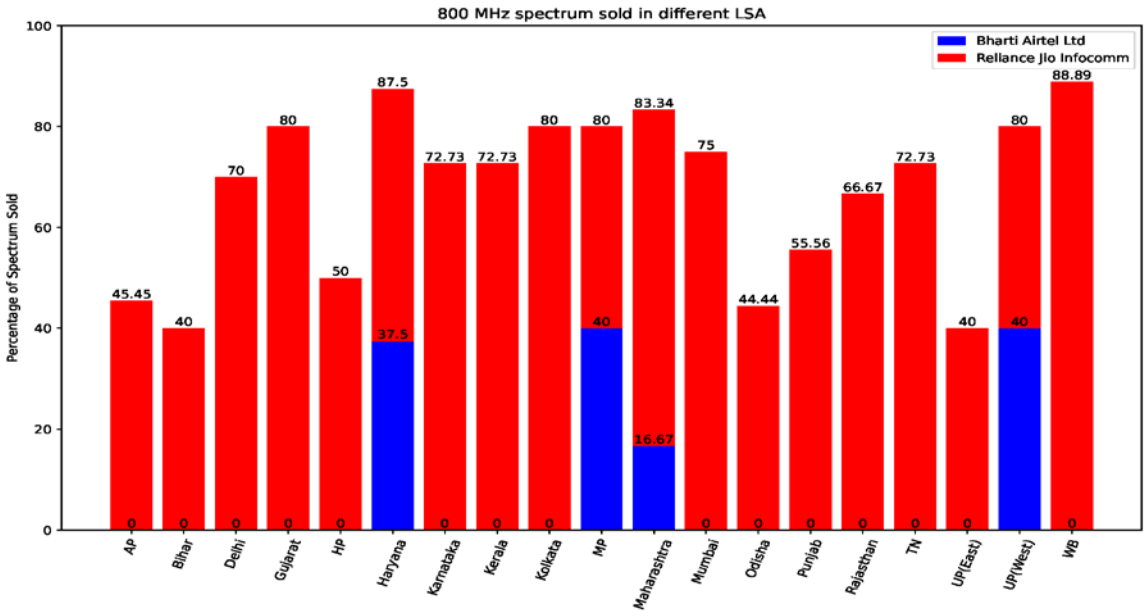

Fig 7

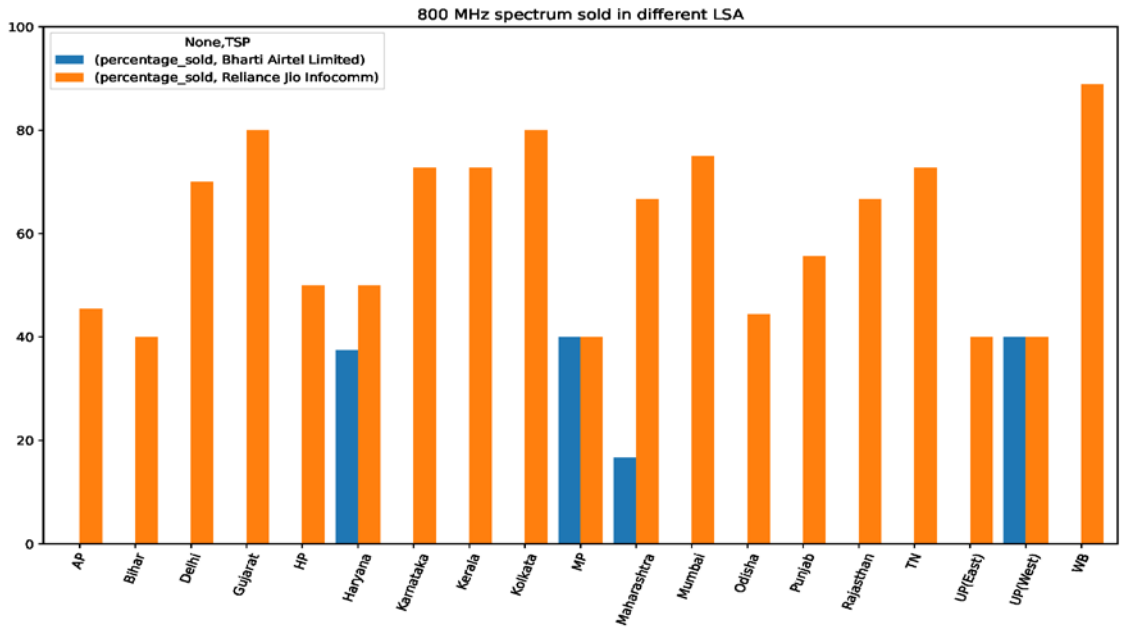

Fig 8

(ii) 900 MHz: - Two Operators M/s Bharti and M/s Jio bought 900 MHz spectrum. The former bought spectrum in 9 LSA and the latter only in 2 LSA. In percentage terms, Gujarat and Kerala topped the list with 100% of the available spectrum getting sold. The lowest is in North East where only 24 % was sold from the available spectrum. The plots below (fig 9 and fig 10) show the total percentage of spectrum sold in each LSA in vertical stacked bar chart and vertical grouped bar chart respectively depicting the two operators sharing the band.

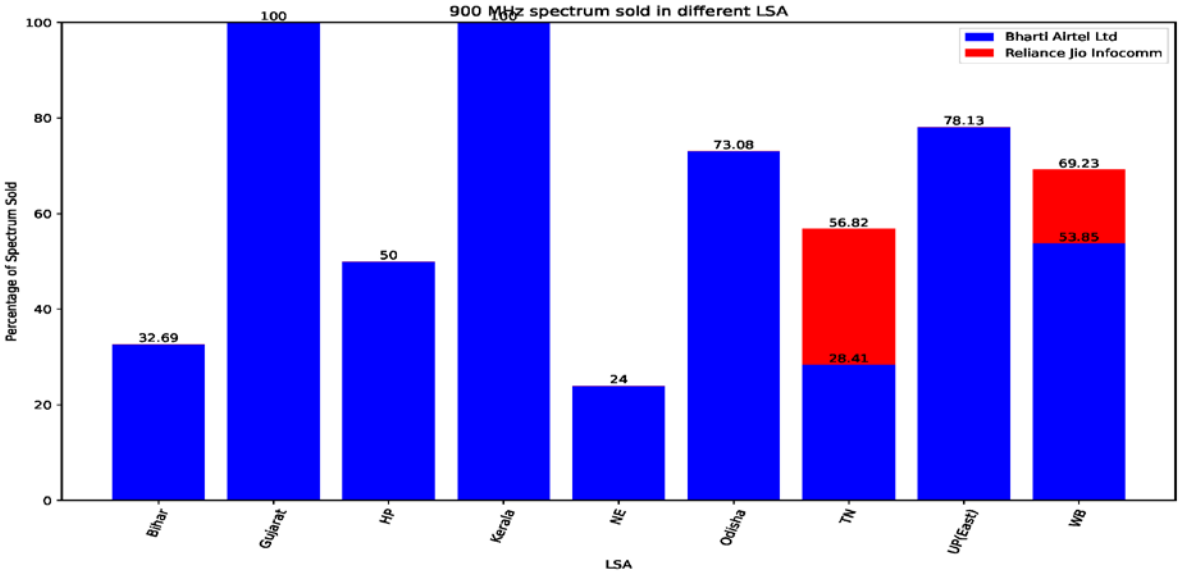

Fig 9

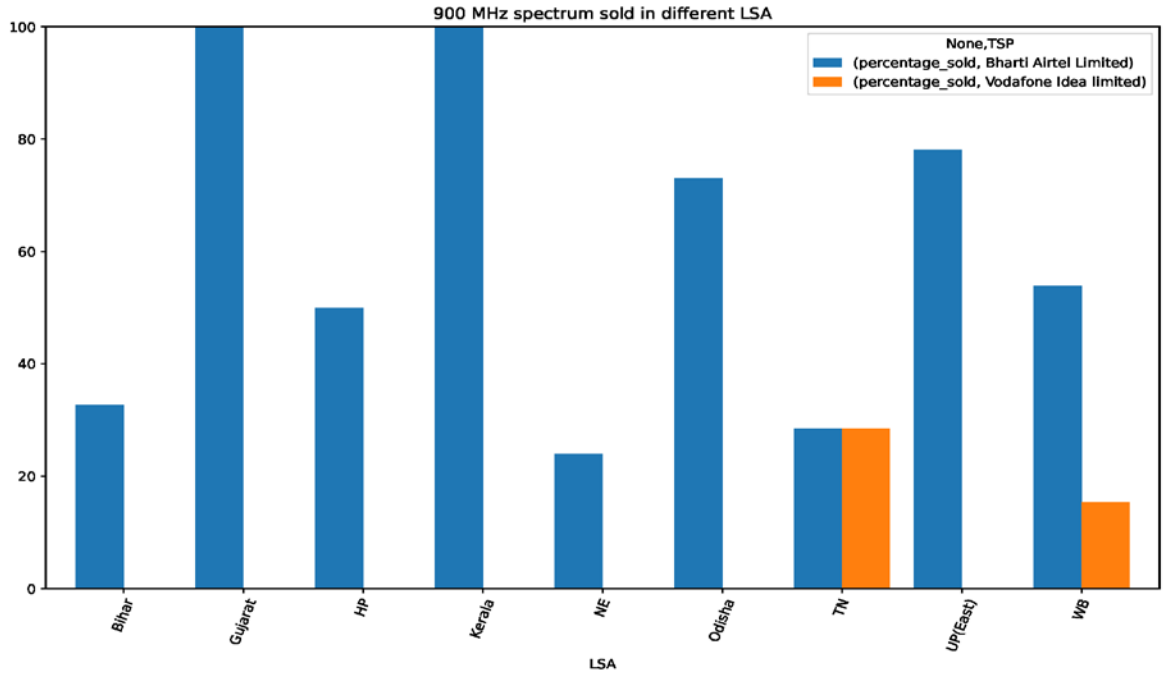

Fig 10

(iii) 1800 MHz: - All the three operators, namely M/s Bharti and M/s Jio and M/s Vodafone Idea Ltd bought 1800 MHz spectrum. Bharti bought spectrum in 13 LSA, Jio in 17 LS and Vodafone in 3 LSA. In percentage terms, Orissa topped the list with 100% of the available spectrum getting sold. The lowest is in Kolkata where only about 7 % was sold from the available spectrum. The plots below (fig 11 and fig 12) show the total percentage of spectrum sold in each LSA in vertical stacked bar chart and vertical grouped bar chart respectively depicting the three operators sharing the band.

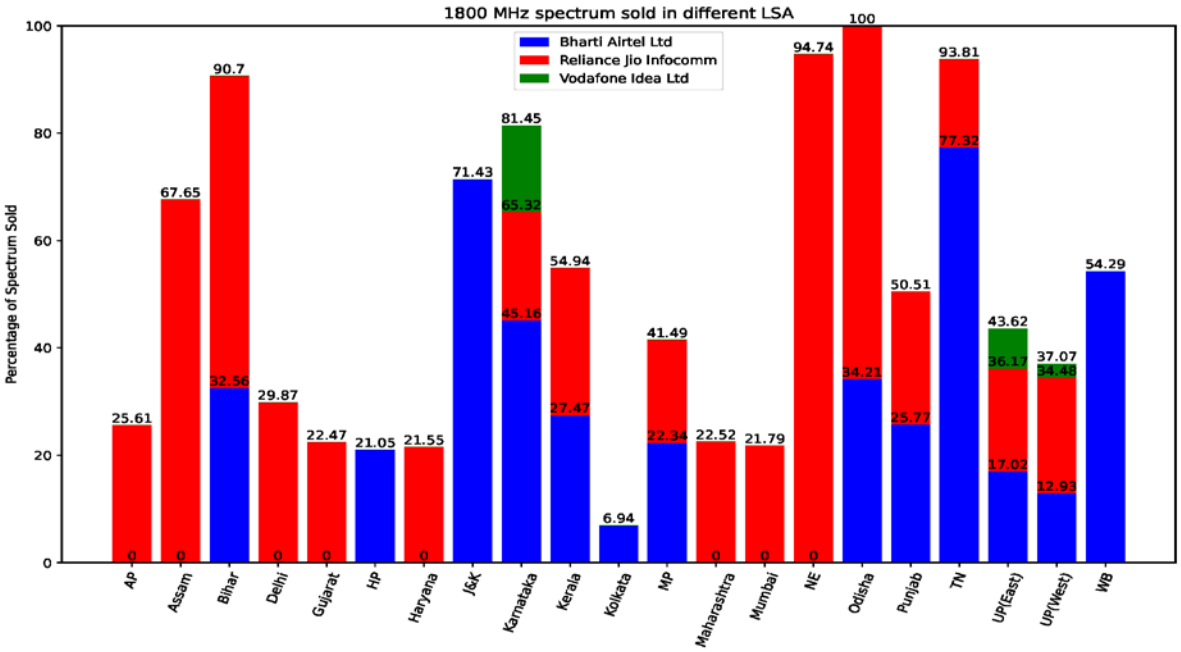

Fig 11

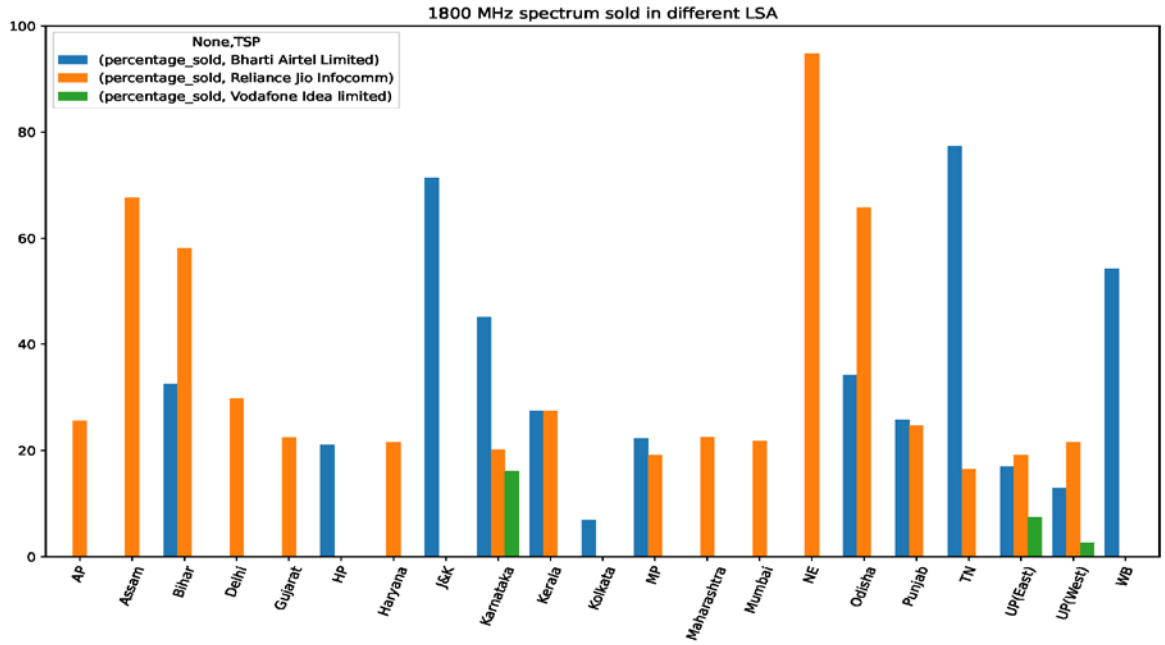

Fig 12

(iv) 2100 MHz: - M/s Bharti is the only operator who bought 2100 MHz spectrum. The TSP bought spectrum in three LSA, Assam, NE and WB. In percentage terms, 50 percentage of the available spectrum was bought by Bharti in all three LSA. The plots below (fig 13 and fig 14) show the total percentage of spectrum sold in each LSA in vertical stacked bar chart and vertical grouped bar chart respectively depicting the status of this band.

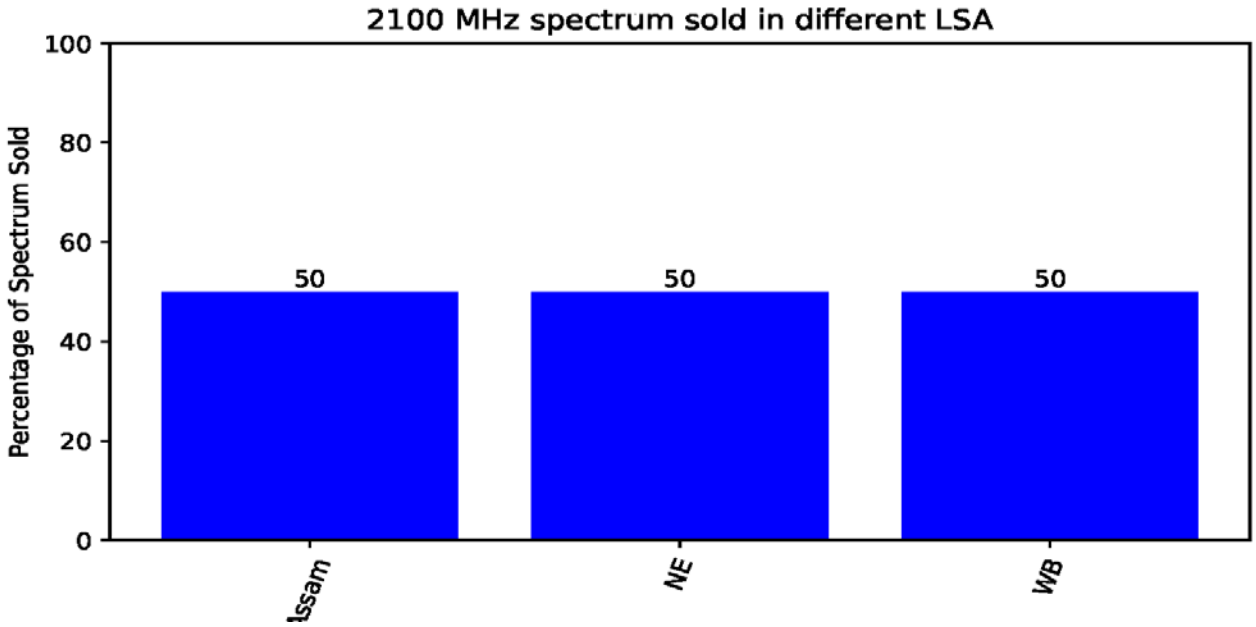

Fig 13

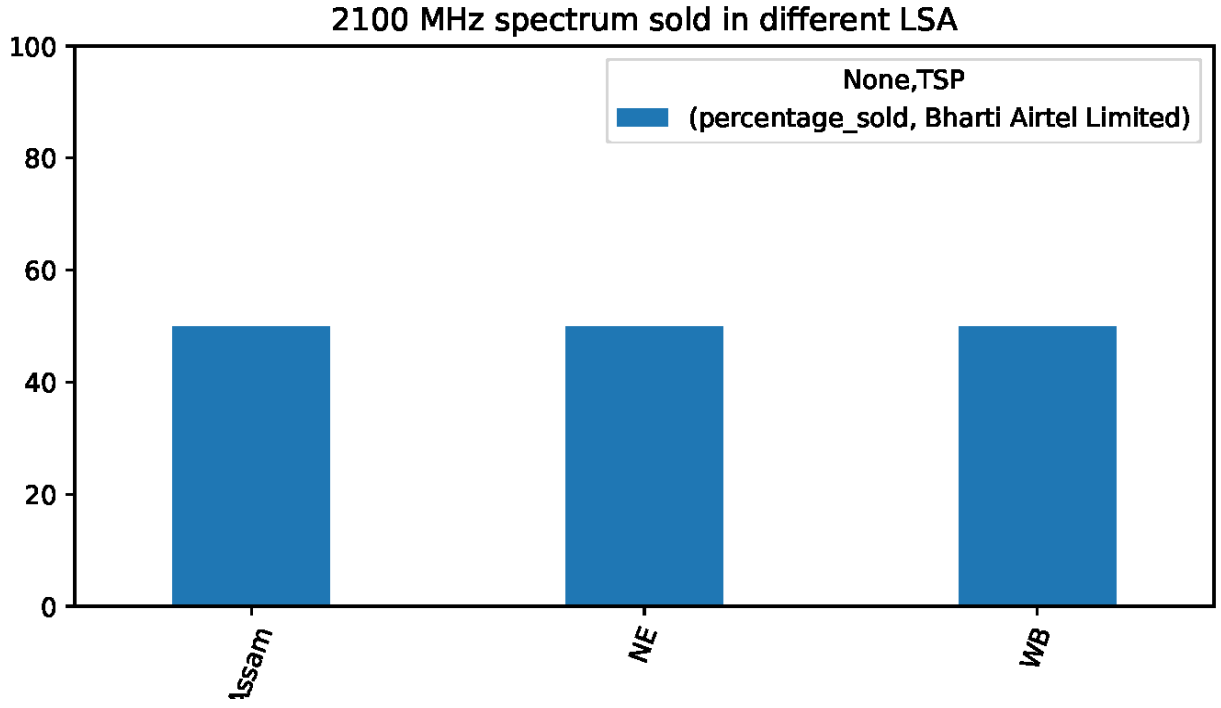

Fig 14

(v) 2300 MHz: - Two operators, M/s Bharti and M/s Jio bought 2300 MHz spectrum. The former bought spectrum in all LSA and the latter in 16 LSA. In percentage terms, 100 % of spectrum was bought by these two operators in 16 LSA. The plots below (fig 15 and fig 16) show the total percentage of spectrum sold in each LSA in vertical stacked bar chart and vertical grouped bar chart respectively depicting the two operators sharing the band.

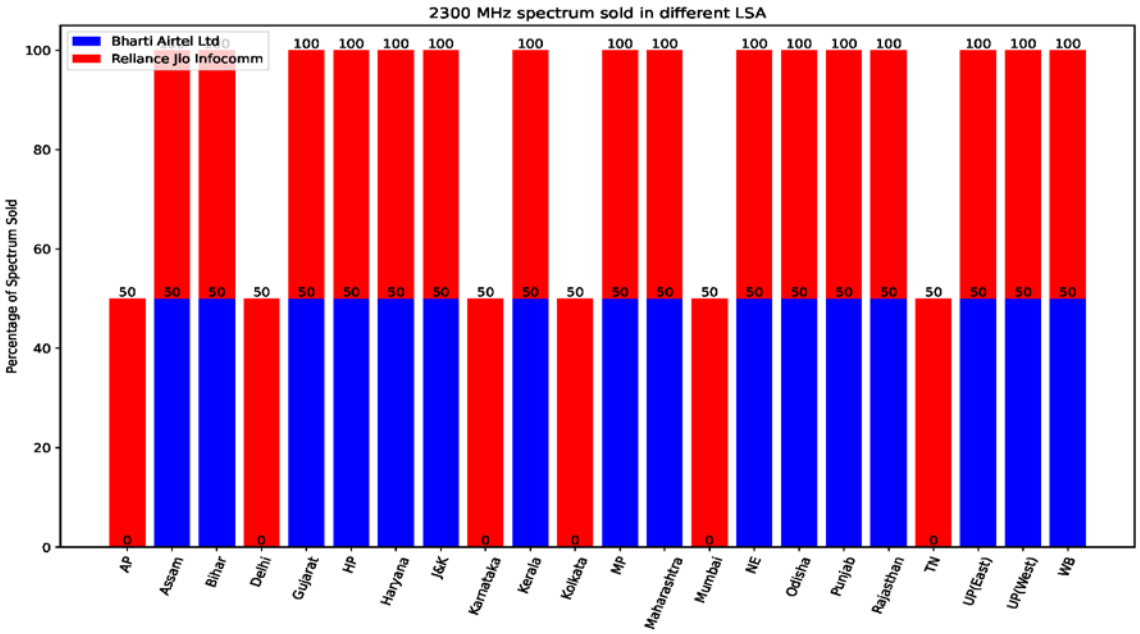

Fig 15

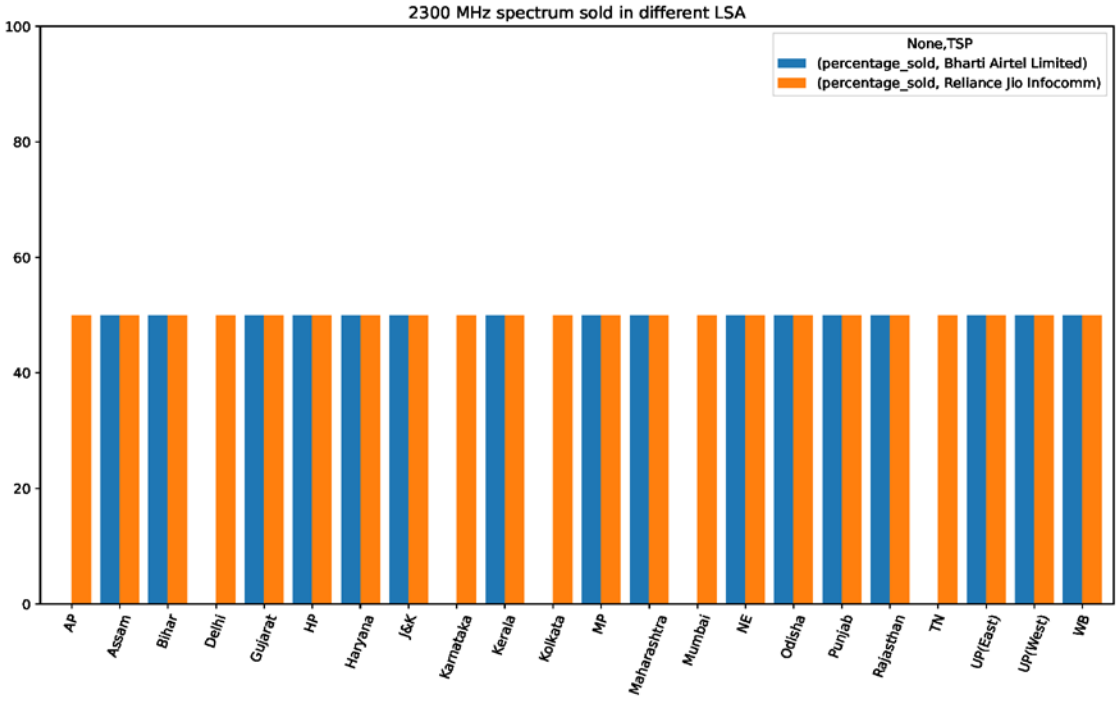

Fig 16

3. <u>The outcome of the auction in terms of the spectrum blocks sold against the blocks offered in various LSA.</u>

(i) 800 MHz: A direct comparison can be made in terms of the number of blocks traded in all the LSA as depicted in the plot below (Fig 17). In three LSA, no spectrum was sold as shown by the zero values in the plot.

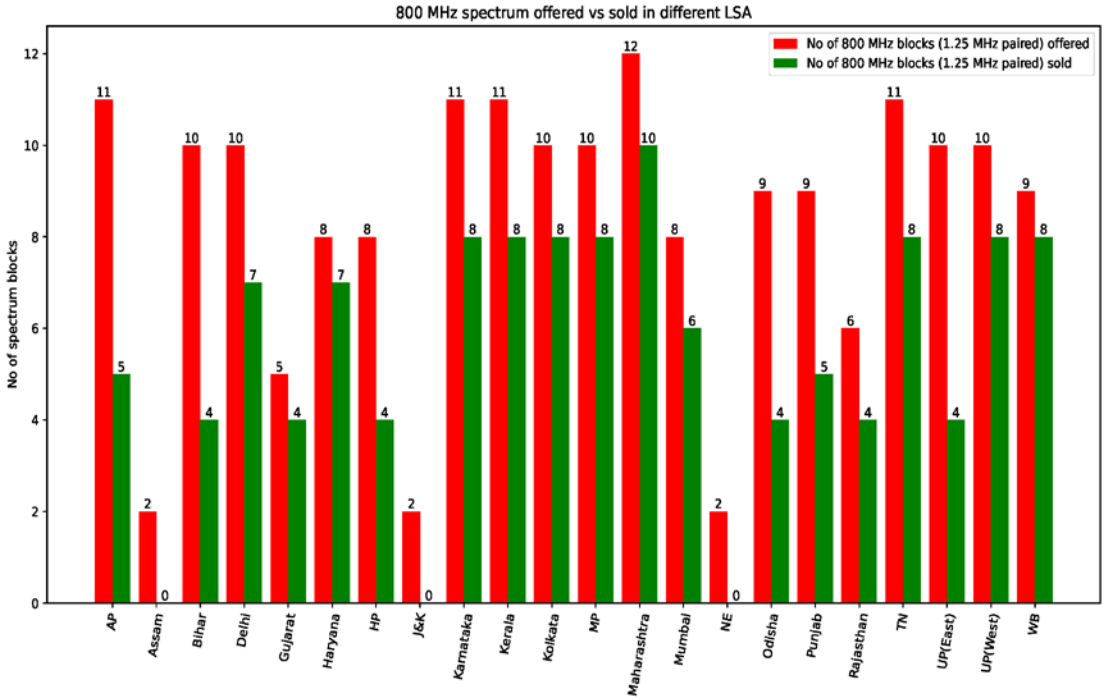

Fig 17

(ii) 900 MHz: A direct comparison can be made in terms of the number of blocks traded in all the LSA is depicted in the plot below (Fig 18). In ten LSA, no spectrum was sold as shown by the zero values in the plot.

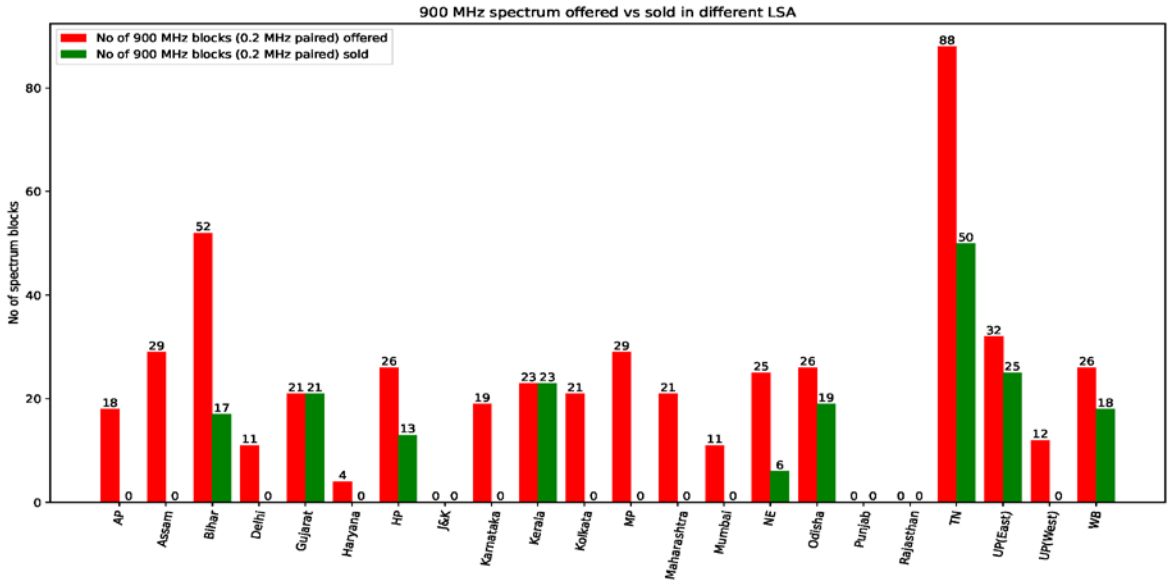

Fig 18

(iii) 1800 MHz: A direct comparison on the sale of spectrum can be gauged in terms of the number of blocks traded in all the LSA from the depicted plot below (Fig 17). In one LSA (Rajasthan), no spectrum was sold as shown by the zero values in the plot:

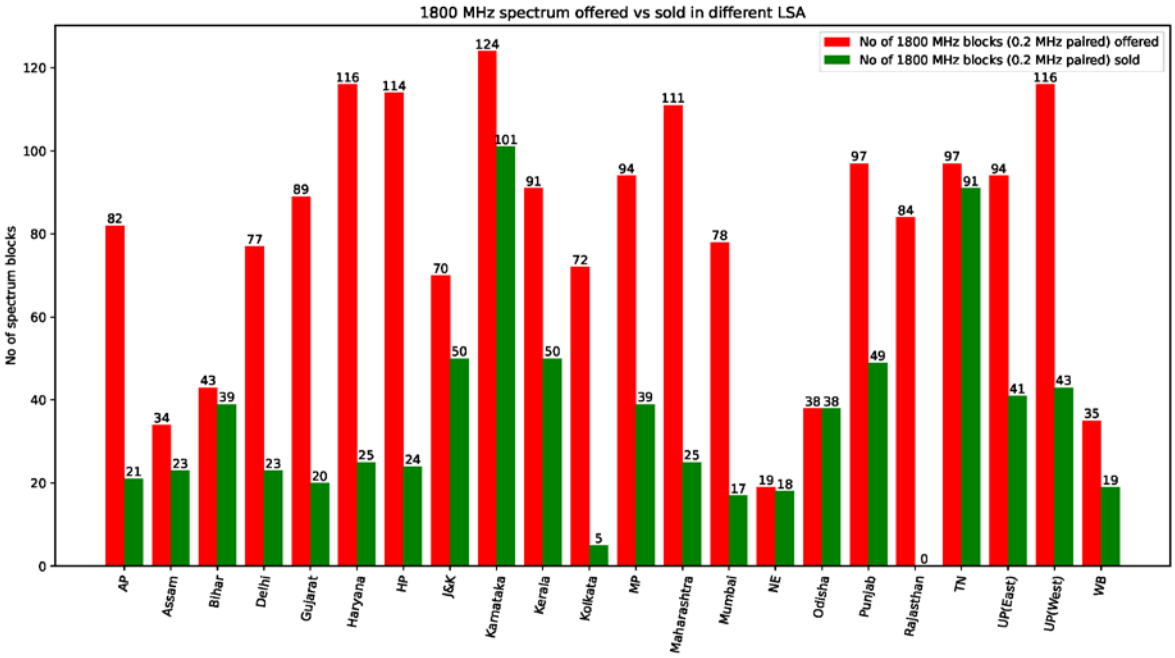

Fig 19

(iv) 2100 MHz: A direct comparison can be made in terms of the number of blocks traded in all the LSA from depicted plot below (Fig 20). In three LSA, no spectrum was sold as shown by the zero values in the plot.

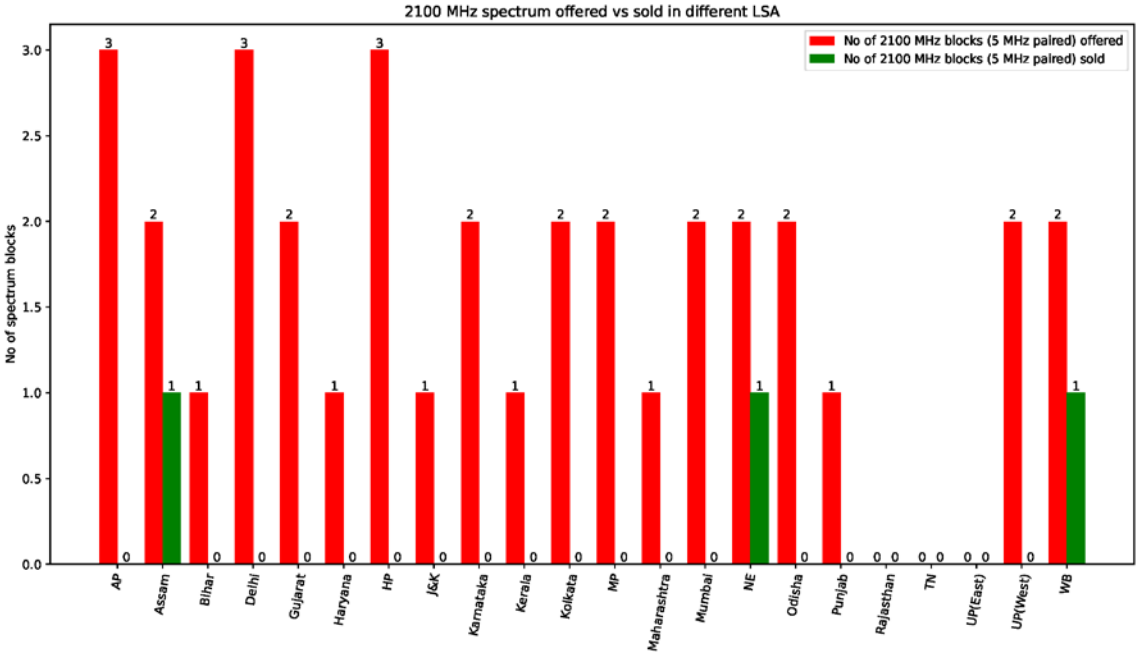

Fig 20

(v) 2300 MHz: A direct comparison can be made in terms of the number of blocks traded in all the LSA from depicted plot below (Fig 21). Spectrum was sold in each of the 22 LSA.

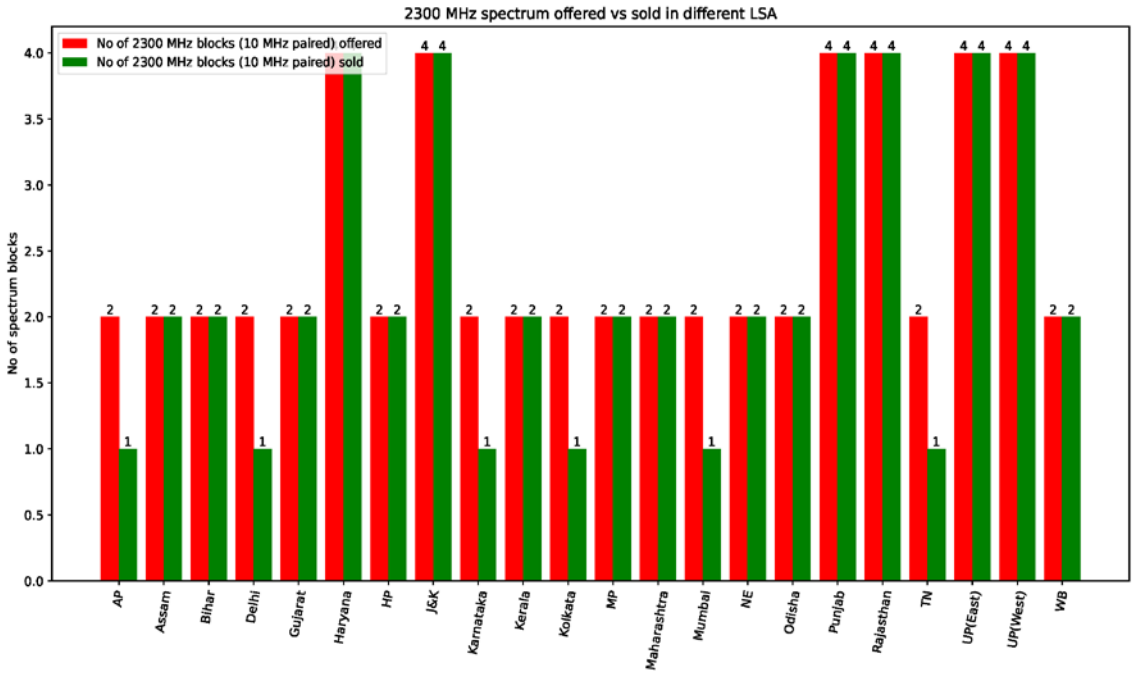

Fig 21

(vi) 2500 MHz: A direct comparison can be made in terms of the number of blocks traded in all the LSA as depicted in the plot below (Fig 22). No spectrum was sold in any of the LSA wherever spectrum was offered for sale, as shown by the zero values in the plot.

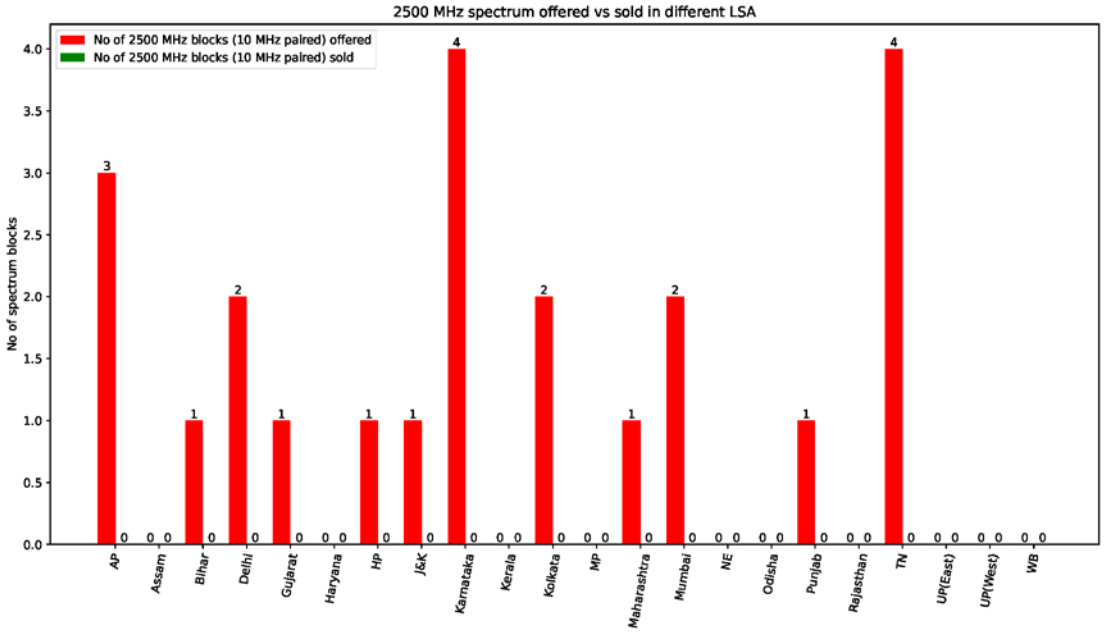

Fig 22

4. <u>The outcome of the spectrum in terms of the revenue collected in various LSA.</u>

(i)800MHz: Here three parameters are plotted in a single plot- the number of blocks sold, the selling price per block and the total revenue in each LSA. The gross revenue is also recorded in the plot. (Fig 23)

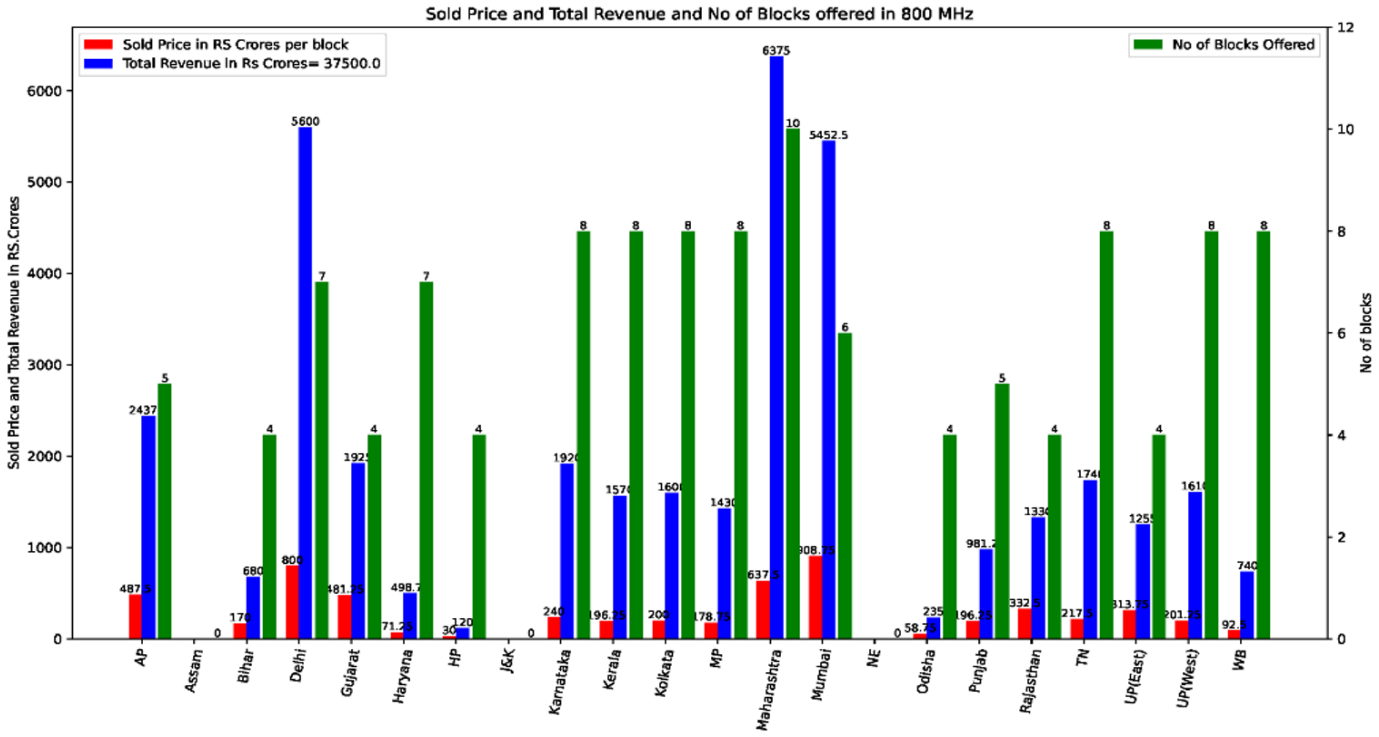

Fig 23

(ii) 900 MHz: Here three parameters are plotted in a single plot- the number of blocks sold, the selling price per block and the total revenue in each LSA. The gross revenue is also recorded in the plot. (Fig 24)

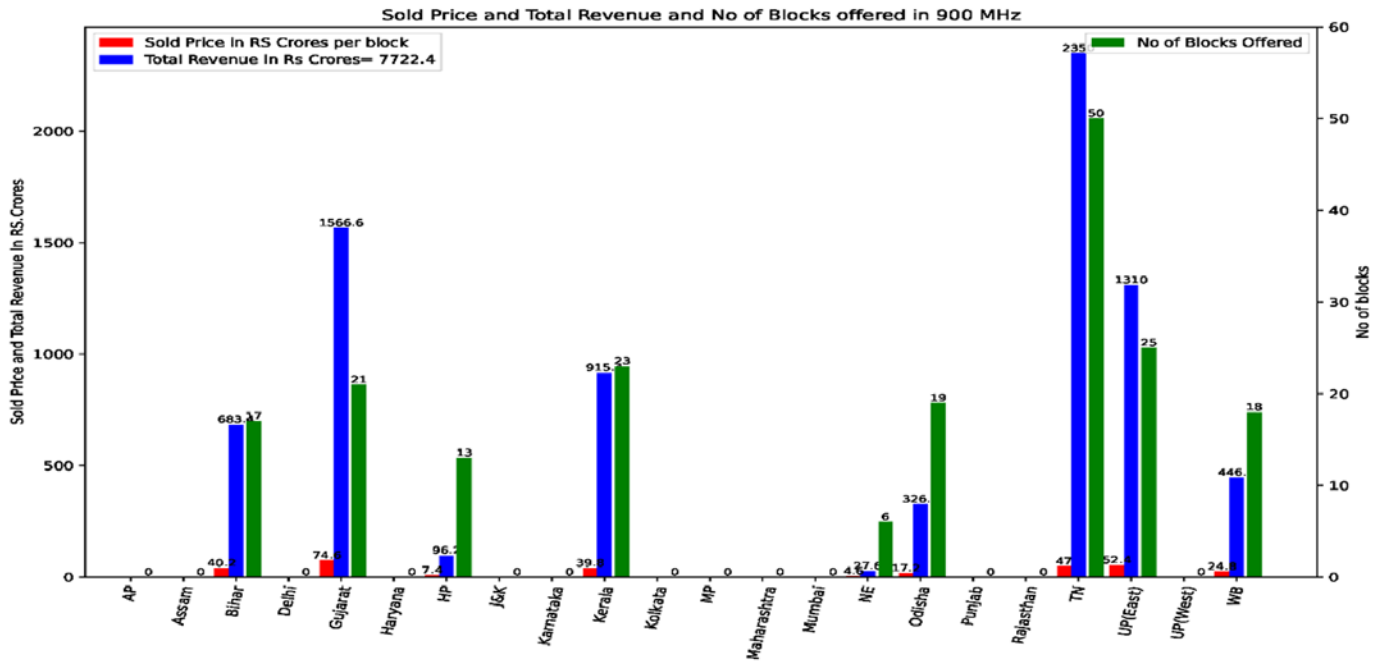

Fig 24

(iii) 1800 MHz: Here three parameters are plotted in a single plot- the number of blocks sold, the selling price per block and the total revenue in each LSA. The gross revenue is also recorded in the plot. (Fig 25). In Rajasthan LSA spectrum was not sold.

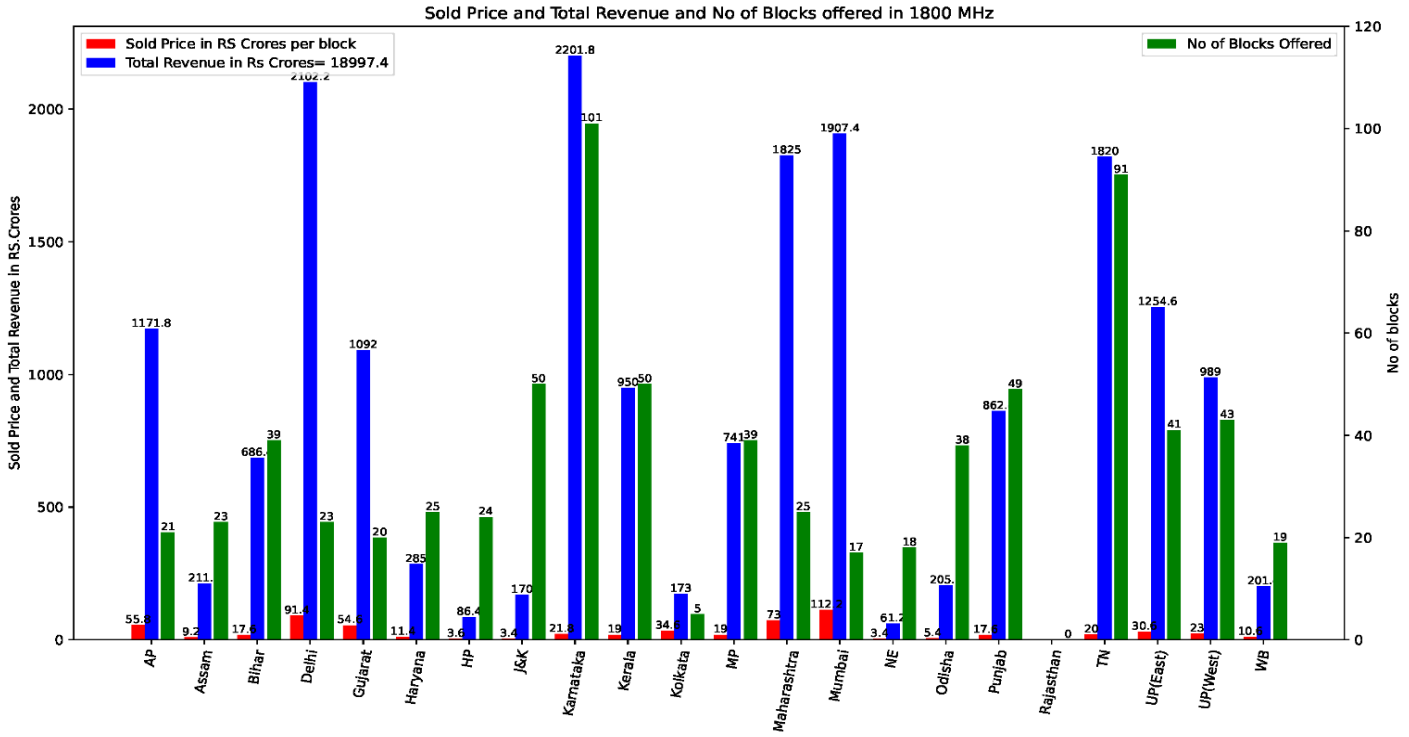

Fig 25

(iv) 2100 MHz: Here three parameters are plotted in a single plot- the number of blocks sold, the selling price per block and the total revenue in each LSA. The gross revenue is also recorded in the plot. (Fig 26). Spectrum was sold only in Assam, NE and WB LSA).

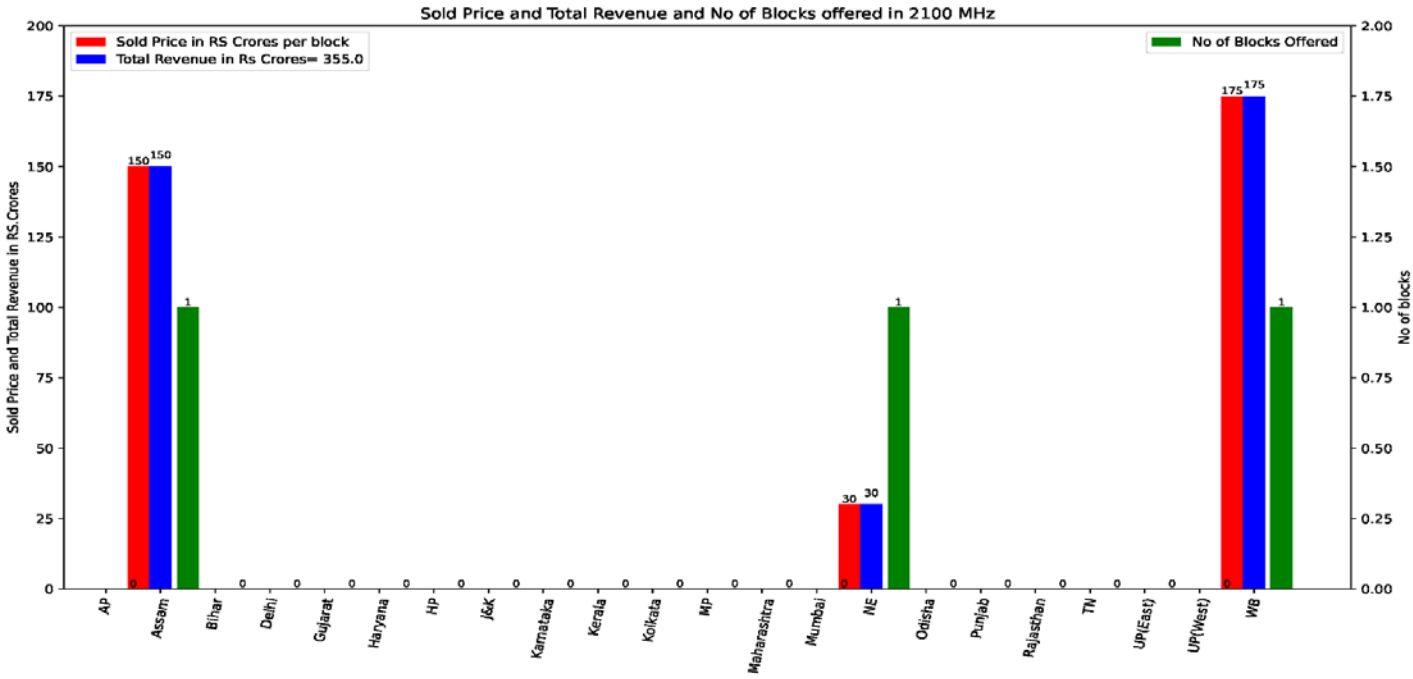

Fig 26

(v) 2300 MHz: Here three parameters are plotted in a single plot- the number of blocks sold, the selling price per block and the total revenue in each LSA. The gross revenue is also recorded in the plot. (Fig 27)

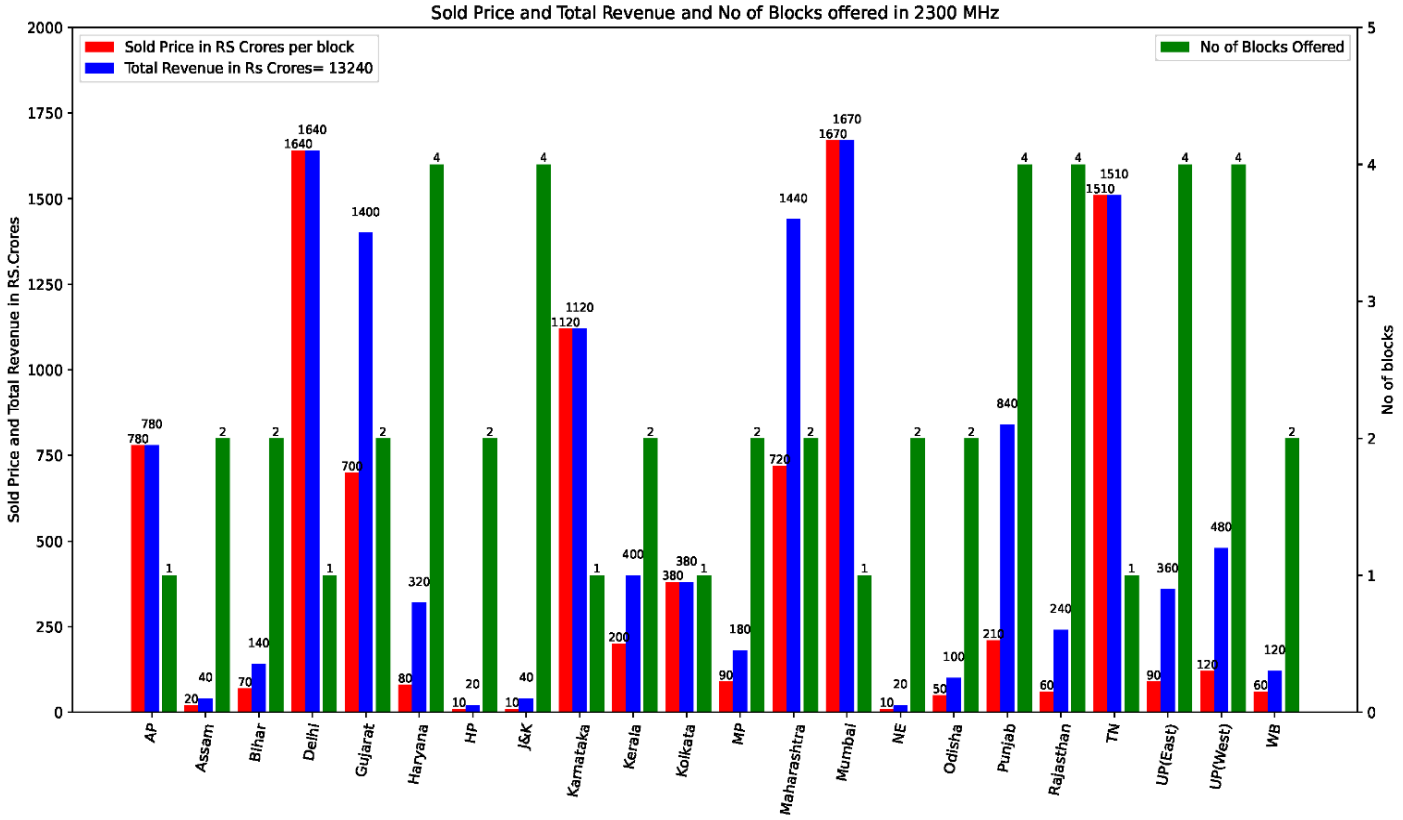

Fig 27

(vi) 2500 MHz: A comparison of the reserve price per block and auctioned price per block in each of the LSA wherever spectrum was sold. As the spectrum was not sold in any of the LSA, only the Reserve price is shown in the plot (Fig 28 and Fig 29)

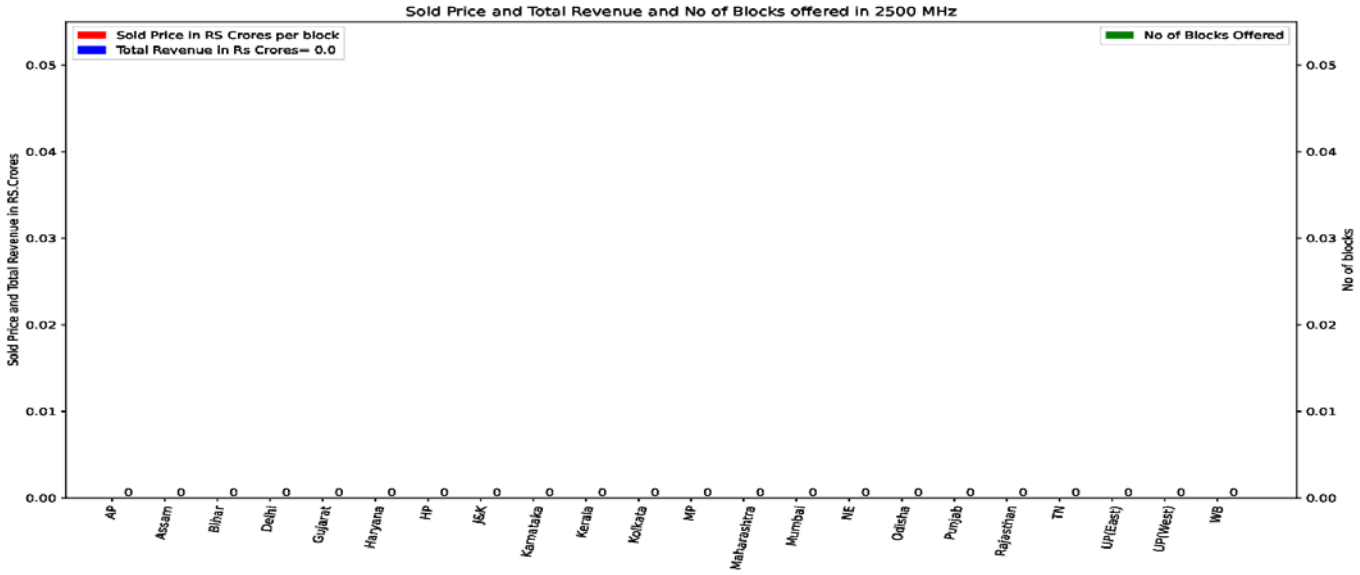

Fig 28

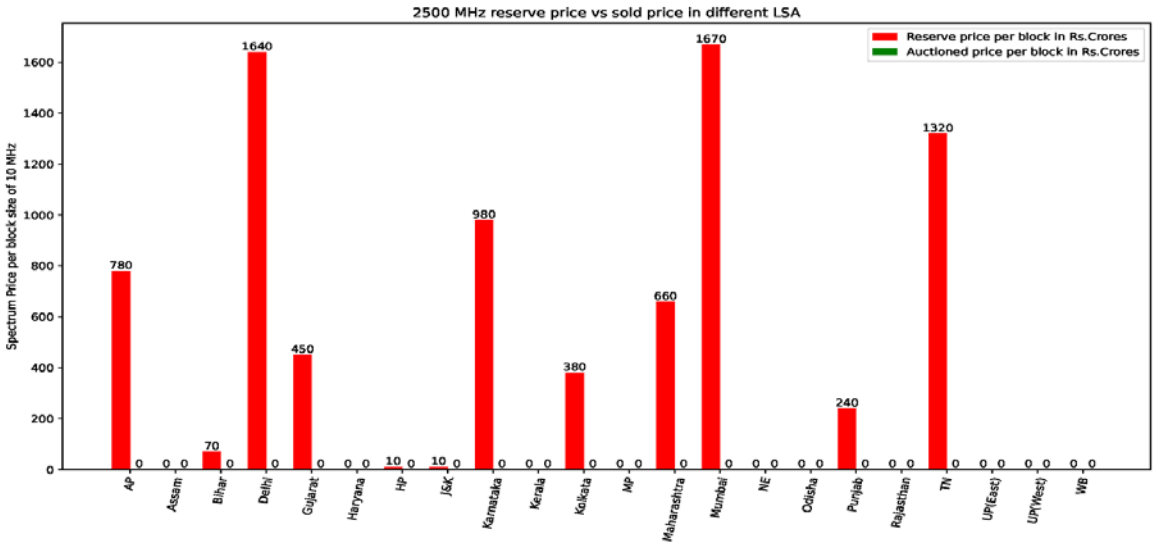

Fig 29

5. The suggestions with regard to the viability of selling 700 MHz spectrum?

It is interesting to observe from the above report that the bands 800 MHz and 2300 MHz were the most resourceful in the sense that they account for 65% of the total revenue receipts from the auction. The major part of this spectrum was purchased by M/s Jio and remaining by M/s Bharti, probably with an eye on their future expansion. However, there was zero interest in the 700 MHz band from either of them.

Another point to observe is the demand of spectrum in the online process. As per the auction rule, "Excess demand for an LSA is defined as the total no of bids received at a clock round prices – the number of blocks available in that LSA. If the Excess demand is negative, the clock round price for next round is set equal to the same as the last round. If Excess demand is zero or positive, the clock round price for the next clock round will be equal to the clock round price in last round plus a positive increment." In this auction, barring 16 LSA for 2300 MHz, 2 LSA for 900 MHz and one LSA for 1800 MHz where the excess demand rose to 'zero' level in the first clock round, in remaining cases the Excess demand always remained negative value. In such situation, there is no scope of raising the clock round price. Even in the cases of 'zero' Excess demand, the bidders did not submit any bid at the raised (with a positive increment) clock round price. As a result, the spectrum has to be offered at the price determined in the previous clock round. Overall, the auction price determined equalled the reserve price without adding any 'positive increment'. However, in the case of 700 MHz, none of the bidders pressed the 'bid decision' button to change it from 'No' to 'Yes' in the first clock round. As a result, 700 MHz remained unsold in the auction.

As per the NIA, the reserve price of one blocks (5 MHz paired) 700 MHz spectrum at pan India level is Rs. 32,905 Crores. At this rate, the calculation yields Rs. 197430 Crores for 6 blocks of spectrum at national level. This spectrum is lying unsold from 2016 onwards when it was auctioned for the first time. On both occasions, it was not sold in any LSA showing the lack of demand for 700 MHz spectrum. It has been considered as the most useful spectrum for 5G services. It may be ironic that such a precious spectrum has not takers. However, in economic terms, if there is no demand for any commodity that is available in surplus, the seller has to determine the equilibrium price, which in any case would be below the current reserve price.

The lack of demand can arise from various reasons. It may be likely to do with the unavailability of mid spectrum of 3-4 GHz spectrum and the millimetre wave of 26 GHz spectrum both of which are to complement the 700 MHz spectrum for 5G services, a crucial technical aspect. Another possibility is that the current requirement of 4G (LTE) has already been met by either 850 MHz or 900 MHz bands for all the telecom service providers. As for 5G NR, with technological advances, 3GPP plans are available either in the 850 MHz (N5 –FDD) or 900 MHz (N8-FDD) which offer alternate choices for 5G implementation even though 700 MHz APT plan (N28-FDD) is the one that was originally conceived for 5G. Thus it can be argued that with the standardisation of different bands for NR, there are plenty of options and hence no pressure on TSP to afford to miss the 700 MHz 'expensive' band.

The spectrum is idling for the last 5 years. If spectrum is not utilized, there is a financial loss as the same would have been utilized otherwise for providing service. Is there a way out? There are few possibilities which can be explored:

1. Use a different category of auction other than SMRA ascending auction. There are different types of auctions- Dutch auction, Sealed first-bid auction, Sealed second-bid auction etc. These different flavours can be experimented after each methodology is analysed carefully. In Dutch auction, it is a descending auction that normally start with a very high value, gradually coming down whiles the auction progress. The reserve price can be kept at a lower price to attract the buyers and will be effective in selling the spectrum, before the price reaches the reserve price unless there is collusion among the buyers. To start with, the spectrum auction can be attempted in pilot mode in the Metros first as there is likely to be a higher demand to implement 5G in metros initially. Subject to its success, it can be replicated in other LSA.

2. The Department can seek the help of Academia for the best possible methodology of auction or bidding without sacrificing the transparency and optimising the revenue. Adequate spectrum and its availability are the first criteria to make the spectrum auction feasible. There are 6 blocks of spectrum in each LSA which meets this criterion. As we have seen in this auction, in whichever LSA more number of blocks available, there were higher percentages of sale of spectrum. The 'administrative allotment', beauty parade methodologies etc are not feasible as such methods can invoke the contempt of court against the DoT, as auction is the preferred method suggested by the Supreme Court in 2012 in its order.

3. The third possibility is to attract other telecom service providers also apart from TSPs who directly want to jump into 5G service (remember Reliance Jio in 2014 started their service directly with 4G). Another business model has to evolve to implement this. Since the cost of Capex to start 5G is quite high, new service providers are unlikely to enter this field. The ISP, Broadband service providers, OSP, VNO, Carrier service operators etc can be allowed to participate in the auction. If we can divide LSA into different districts, then the spectrum can be divided as well in that LSA. If, for example, a LSA is divided into 5 parts, allowing operators to share one LSA, then we would see higher participation of bidders in each LSA. The successful micro level players can set-up the network at a regional level and by making a tie-up with major Service providers each would be able to provide inter-regional and thereby national coverage in 5G. As these concepts are hypothetical, a preliminary study has to be conducted by TRAI for its viability.

Reference:-

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