AUCTION DESIGN AND ITS IMPACT ON COMPETITION
-With Reference to the Spectrum Auctions in the Indian Telecommunication Sector

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INTRODUCTION

It was once believed that spectrum is the property of the government, and hence the government could use it in a manner that suited it and that the government had exclusive rights to regulate and allocate spectrum. But post 1995 this belief has changed. This has been possible due to a historic judgment given by the Hon’ble Supreme Court of India in 1995 in the case of Secretary, Ministry of Information and Broadcasting, Govt. of India v. Cricket Association of Bengal which decided that spectrum is actually public property. This judgment has changed the perception of ownership of spectrum in India and the way the government handles & manages spectrum in today’s scenario. India is not the only country to hold the view that the spectrum is public property. Most of the developed countries like USA, Canada, UK, etc. hold the same view that spectrum is public property and the government is only the caretaker of this public property.

Scarce natural resources of a nation demands efficient utilisation. These resources are commonly owned and hence form part of public property and therefore any allocation of the same for private use (to create utility) needs to be efficiently determined. There are several mechanisms in literature to accomplish this assignment. Governments have tried Beauty contests, lotteries, FCFS and other such arbitrary opaque mechanisms.

Beauty contest is an administrative process whereby those interested in obtaining the object make a proposal to the government on how they intend to use it. After the going through all such proposals the authority awards the resource to the most attractive proposal. This system is full of flaws, subject to manipulation and therefore inefficient. There is ample scope of undeserving candidates (with comparatively low values or poor technology) to obtain the resource either by overstating their case in a rosy manner or making side payments to the authority. Also, tacit collusion among buyers and government officials can result in very low sale prices causing major harm to the exchequer. Thus neither is there any price discovery nor transparency in beauty contest.

Lotteries were introduced to allocate the resources (spectrum licenses in our case) in a random manner. Under lotteries the license winners are chosen randomly from among those that apply. The problem here is that the licenses are enormously valuable and hence there is an incentive for large numbers to apply (since its random allocation after all), this in turn leads to inefficiency and rent seeking. The winners are not necessarily those who are best suited to make use of the resource. Even transfers through private market transactions (secondary trading) from low value to high value took years in case of nations which went through this process.

FCFS- First Come First Served works as its name goes. The private entities who apply first get the object allocated first at an arbitrary price set by the authorities. This is again full of
inefficiencies since the first applicant need not be the deserving candidate in terms of efficient utilisation. Moreover there is no price discovery of the scarce valuable resources (they are expected to be officially undervalued in the face of rampant corruption seen in case of 2G scam in India). Thus there is wide scope for manipulation and collusion and other corrupt practices in this mechanism.

Finally the disadvantages all such mechanisms gave way to the more efficient Auctions. On 8 February 2011, GoI set up a high powered committee headed by former finance secretary Ashok Chawla to suggest a roadmap for efficient and transparent distribution of scarce natural resources such as telecom spectrum. It was decided that the ambit of the committee shall be restricted to those natural resources, which are not man-made and are under the direct control of Central Government or any of its agencies. These will include land, water, minerals (including petroleum products like oil and gas) and radio frequency (spectrum). The committee will consider multiple issues such as public welfare, revenue maximization, sectoral precedents etc. The Chawla Committee concluded that auctions were the only transparent mechanism to assign the scarce resources. Also on 2nd February 2012, the Supreme Court verdict came with the respect to the 2G scam in India. The Hon’ble Supreme Court declared the process of allocating 2G licenses through so called FCFS as “wholly arbitrary and unconstitutional action” an cancelled all the 122 licenses while ordering re-allocation through auctions.

Efficient allocation is of primary importance when assigning scarce resources to private entities because such resources are limited and thus the objective should be to minimise wastage or maximise the utility created by use of such resource; which can be ensured only by allocating the resource to the most deserving candidate, one who values the resource the most and who has the most efficient technology and infrastructure to create maximum social value out of the resource input.

Competition is all the more important in assignment of resources as well as auction designing because inefficient allocation mechanism can lead to distortion in market structure. The most obvious possible distortion is that since firms’ joint profits in a market with fewer competitors are greater, it is worth more to any group of firms to prevent entry. As a result when too few firms win shares of spectrum they may go on to create a highly concentrated industry at the cost of consumer welfare. Thus, it is extremely important to study the implications on competition of various auction designs to safeguard consumers against exploitation in form of higher tariffs etc. and maximize social welfare.

A well-designed auction is the method most likely to allocate resources to those who can use them most valuably. Rather than relying on government bureaucrats to assess the merits of competing firms’ business plans, an auction forces businessmen to put their “money where their mouths are” when they make their bids. An auction can therefore extract and use information otherwise unavailable to the government. Thus it is the most efficient way of allocating resources while ensuring competition.
Before proceeding further let us discuss certain popular myths and objections to auctions. Sometimes it is alleged that auctions raise consumer prices, they are unfair to firms and also reduce investment. All these allegations become baseless when we delve into the strong economic theory. The most common fear is that spectrum costs generated through auction are high and these costs are passed on to consumers in the form of higher prices. The argument is mistaken since spectrum costs form one-time sunk costs (those which cannot be recovered) and the profit maximising calculations do not consider such costs, so that the telecom companies charge profit maximising tariffs independent of the spectrum cost. Another belief is that firms are made to pay too much and “forced to bid”. However auctions aim at determining price via market mechanism, as such when the spectrum prices are discovered through interaction of the forces of demand and supply in a competitive environment it is bound to be the most efficient prices no matter how high it seems to those habituated to arbitrary and opaque price fixation. Last but not least, firms usually advocate that large spectrum costs make them liquidity constrained and forces to reduce investment on other aspects of the business. Theoretically it is valid argument but on practical grounds it is unlikely that very many highly profitable investments would be forgone because of difficulty in funding them in the present dynamic global economic environment where capital market constraints are weak enough to suffocate big projects.

Now, we move on to the essentials of an efficient auction design is that it should facilitate price discovery and induce truthful bidding. Determination of prices through a competitive market mechanism and the resultant allocation to the one who values the object the most is what any efficient auction design aims at.

In this report we will learn more about the designs and concepts in auction theory and what impact do the design specific features have on competition. The impact of competition is not only affected by the design but also by the objectives and policies of the auctioneer. The seemingly conflicting revenue and efficiency goals of the auction decides to a large extent the resultant market structure based on the priority they command for the auctioneer. In the subsequent chapters we figure out certain auction designs practiced in several famous auctions. We will also analyse the Indian 3G auction and the recent recommendations by TRAI on conducting the 2G auctions and try to infer their impacts on competition. Last but not the least, the purpose of this study also entails emphasising on the role of the Competition Commission of India and the provisions of the Competition Act, 2002 and its applicability in spectrum auctions. It stresses the relevance of CCI as a watchdog against anti-competitive behaviour and highlights its advocacy role in spectrum auction designing and related policies.
AUCTION DESIGNS AND CONCEPTS

The word auction is derived from the Latin *augere*, which means “to increase” (or “augment”), via the participle *auctus* (“increasing”). Auction is a mechanism to allocate resources and a well-designed auction is the method most likely to allocate resources to those who can use them most valuably. Spectrum auctions are used by governments to assign and price licenses for wireless communication. In face of the decision by DoT to delink of spectrum from licenses the spectrum auctions in Indian context would necessarily imply allocation of scarce spectrum (in MHz) to the telecom companies.

Spectrum auctions have been used by various governments to assign and price spectrum for over two decades still there is no common consensus on any particular spectrum design. There are various auction designs in the literature suited to different situations.

Designing spectrum auctions is as much art as it is science. Paul Klemperer, an advisor (together with Ken Binmore) to UK government’s Radiocommunications Agency on the design and conduct of one of the most successful spectrum auctions, remarks in Klemperer (2002a, b) that it is mainly the NRAs’ inappropriate choice of auction design that led to the failure in some of the early European spectrum auctions.

The objective of most spectrum auctions is three-fold.

- The primary objective is efficiency - the resource should be allocated to those who value it the most, is technologically most efficient and can create maximum utility out of it.

- A Secondary objective is stimulating competition - encouraging entry and participation to induce effective demand and supply interaction in the market for generating market determined prices of the resource as well as provide maximum benefits to consumers from competitive market structure (to create competition for market).

- Another important goal is to generate revenue - allocating spectrum to private entities creates private property rights. Therefore, auction should also generate some revenue for public purse to finance public expenditure and act as a good alternative to distortionary taxes.

As an output, an auction produces two things: (a) An allocation indicating who wins the object and (b) Prices at which the object is auctioned.

The fulfilment of the objectives is conditioned on the auction design and policies employed for that auction. We discuss some of the famous designs in this chapter.

SEALED BID AUCTIONS
• **First-Price Sealed Bid Auction**: In this auction, each bidder is asked to submit a bid. The highest bidder wins the auction but pays an amount equal to his bid amount. It is not necessary that the bidder with the highest value will place the highest bid. This is because the bid amount of a bidder depends on what he believes other bidders are bidding. Under appropriate assumptions, it can be shown that it is equilibrium for bidders to bid below their valuation in this auction by an amount that decreases with the number of bidders. The bidder with the highest value (although bidding below his valuation) always bids the highest in such an equilibrium (Krishna, 2009). Despite the complex analysis of equilibrium, the first-price sealed-bid auction has the merit of being extremely simple. This is borne out by the fact that it is one of the most widely used auctions in general.

• **Second-Price Sealed Bid Auction or Vickerey Auctions**: The second-price sealed-bid auction also asks buyers to place a bid on the object. The highest bidder wins the object but pays an amount equal to the second highest bid. Vickrey (1961) showed that an optimal strategy for every bidder is to bid his true valuation irrespective of what she believes others will bid. Despite this elegant theoretical property, Vickrey auctions are not frequently used in practice.

**OPEN BID AUCTIONS**

• **English (Ascending) auction**: In an ascending price English auction the seller starts the auction at a very low price (possibly zero). The bidder who wants to win the object increases the price. The auction ends when there is no price increase. The last bidder to bid wins the object and pays his bid amount. A bidder can be silent for most of the auction and bid at the end (a phenomenon commonly observed in the English auctions conducted on e-Bay.com).

• **Dutch (Descending) auction**: A popular auction is the descending price auction which is the counterpart of the ascending price auction, also known as the Dutch auction - flowers in the Netherlands are sold using this format. The auctioneer sets a high price on the object initially and lowers it continuously. A bidder who expresses his willingness to buy the object first wins the auction at the current price. Theoretically, this auction is equivalent to the first-price sealed-bid auction. Like the first-price sealed-bid auction, every bidder needs to determine an amount at which he must express his willingness to buy in the Dutch auction. Since the bidder who wins the object pays this amount in both the first-price sealed-bid and the Dutch auction, both the auctions are strategically equivalent. One of the problems with the descending price auctions is that the seller must have a good knowledge of the upper bound on the values of the bidders. Otherwise, the seller may lose potential revenue from the auction.
Japanese (clock ascending price) auction: In this mechanism, the seller starts the auction at a low price (possibly zero). Bidders express their willingness to buy the object at every price. If the number of bidders who want to buy the object at the current price is more than one, then the seller increases the price by a pre-determined amount, called the bid increment. The auction stops when there is exactly one bidder who wants to buy the object. Usually, there are activity rules which require each bidder to express his willingness to buy the object at every price in the auction, and once a bidder says no to buy the object at a price, he is no longer allowed to participate in the auction. Theoretically, this auction converges to the outcome of the second-price sealed-bid auction if the bid increment is small enough. As soon as the price in the auction crosses the second highest value, exactly one bidder is interested in the object, and the auction stops. The highest value bidder wins the object and pays a price (close to the) equal to the second highest value. The Japanese auction is also referred to as the clock auction.

SIMULTANEOUS vs SEQUENTIAL AUCTION

When there are several interrelated objects to be sold as a part of a single auction process, for e.g in case of spectrum if licenses are to be sold for various circles as, one may conceive two processes (a) Simultaneous- auctioning and therefore bidding simultaneously on all the objects (auctions for licenses on all circles at the same time), and (b) Sequential- this entails auctioning of objects in a sequence one after another (auction of one circle at a time).

Recent spectrum auction mechanisms were all simultaneous, types being:

- **Simultaneous Ascending**
  The workhorse for spectrum auctions since 1994 has been simultaneous ascending auction, a simple generalization of the English auction to multiple items in which all items are auctioned simultaneously. The bids are continued to be accepted for all the lots or items until the demand equals supply for each item.

- **Simultaneous clock auction**
  Clock auction when applied to multiple objects been auctioned at the same time (as a part of a single auction procedure) is said to be simultaneous clock auction. The bid increments are decided by the auctioneer. Bidding on all items remains active until the equilibrium price is settled for each item.

ANGLO-DUTCH AUCTION: This hybrid auction design was proposed by Ken Binmore and Paul Klemperer to the U.K government for the sale of British 3G telecom licenses. It is a combination of English ascending price in the initial stages and first price sealed bid auction in the final round. The mechanism has been so designed to capture the advantages and discard the disadvantages of both the processes. In an Anglo-Dutch auction for one object, the price rises until all but two bidders quit and the last two bidders then make “best and final” sealed bids with the winner paying the price he bid in this final round. The motive
behind this invention was to promote entry while retaining the information revelation advantage of ascending auction. In case there are four licences to sell, the price would rise until only five bidders remain. The surviving bidders would then be committed to bid at or above this price in a sealed-bid auction in which the four highest bidders are awarded a licence.

COMBINATORIAL AUCTION: Often, multiple objects are available for sale from the seller. Bidders may be interested in all or some packages of the objects for sale. A typical bidder will have values for many possible bundles of objects. Thus, in a simultaneous auction the bid for several objects by any specific bidder is looked upon as a package bid. He holds joint value for the licenses/spectrum for several circles as a package. The presence of such synergy and complementarities among multiple objects makes the sale of multiple objects an interesting problem. Sequentially selling each object one by one makes the strategic behaviour of bidders more complex.

The most popular form of this design is combinatorial clock auction in a simultaneous setting. The advantages associated in the form of price discovery and truthful bidding has been discussed in detail in the later chapters.

Some basic considerations in auction designs

- **Price Discovery**
  The efficiency of any auction design lies in its ability to facilitate the valuation of the scarce resources through the market mechanism. When the forces of demand and supply interact in a competitive market structure then the resultant prices are the most efficient prices (since they are discovered through competition). This role of well-designed efficient auctions in discovering the market determined price is known as price discovery. True and efficient price discovery is only possible in a competitive market and hence it is advocated that the auction designs aimed at determining the value of the scarce public resources like spectrum should be compatible with competition.

- **Revenue and Efficiency**
  Efficient allocation of spectrum means placing spectrum in the hands of those able to create greatest overall benefit from it. Provided that competition between spectrum licensees in providing telecoms services is effective, efficient allocation can usually be achieved by licensing spectrum to whoever values it most.

  Spectrum sales are an important source of revenue for governments. Therefore, some governments have taken an explicit approach of maximising revenue, rather than pursuing efficiency.

  Given the importance of services derived from spectrum for the wider economy, governments are typically best served by seeking to maximise the overall benefit to society from spectrum, rather than simply maximising receipts from spectrum sales in the short-run.
The Indian 3G and BWA auctions in 2010 had an explicit objective of maximising revenue, subject to the requirement that there would be sufficient competition in downstream markets.

**Common features needed for efficiency and revenue**

There are many features of good practice in spectrum allocation that promote both efficient allocation and revenue:

- Spectrum licences need to have clear rights and obligations;
- Spectrum authorities acting in a predictable manner, keeping to previously made commitments and avoiding ‘hold-up’;
- Competition for spectrum should be maximised by providing as much flexibility as possible for bidders to bid for what they want, subject to the need to protect downstream competition.

These features encourage auction participation, which in turn is important for creating effective competition for spectrum and greatly facilitates a successful auction.

- The licensee needs to pay at least the amount that the highest value alternative user of the spectrum would be prepared to pay. This is the so-called opportunity cost of awarding the spectrum – the lowest price that is compatible with losers not wanting spectrum from winners.

- Efficient allocation requires licensees to pay at least the opportunity cost they impose otherwise there will be unhappy losers. An efficient allocation requires a certain minimum amount of revenue to be raised (regardless of whether an auction or some other allocation method is used).

**Reserve Prices**

Reserve price for an object or circle in a spectrum auction is the minimum payment the winning bidder has to make. It is normally driven by some minimum revenue generation consideration.

Important observations about reserve prices in spectrum auctions:

- They discourage frivolous participation;
- They represent minimum guaranteed revenue for the seller in case the object is sold as;
- They can underpin revenue in the case that competition for spectrum is weak;
- The selection of optimal reserve price increases expected revenue;
- The optimal reserve price depends on distribution of values of bidders-

  Myerson (1981) shows that in an ascending price auction with optimally chosen reserve price expected revenue can be maximized among all formats (Krishna, 2009);

- Inadequate reserve prices increases the incentives for predation and/or collusion- A strong bidder can bid aggressively if the reserve prices are low. Also, bidders have a choice of tacitly colluding to keep the final price low and
later sharing the spoil which is not possible if the reserve price is high enough since then collusion would be unprofitable to low valuation bidders.

- Very high reserve prices in turn risk the final object not being sold (which is again inefficient since spectrum is not being put to its best use) because there may be no takers at very high prices, also it is alleged that high reserve prices deter participation of entrants (since the initial set-up costs are as it is high for them).

**Bid-snipping**

Good price discovery is essential in realizing the benefits of a dynamic auction, and good price discovery happens when the structure of the auction induces consistent truthful bidding. Bid snipping- waiting until the last minute to bid seriously, is a strategic activity whereby players in a simultaneous multiple round auction, can conceal their true preferences and interests for an object (circle) throughout the auction and jump in at the last instance on that particular circle (towards which he showed no interest before) in order to win it at low prices. This strategy of holding back information harms true price discovery and thus efficiency. To combat this problem of bid snipping auction theorists came up with *activity rules* essentially designed to prevent bidder from switching preferences drastically towards the final round.

**Activity rules**

With activity rules the bidder cannot play snake-in-the-grass strategy where the bidder holds back and waits, and then pounces late in the auction, thereby winning without making its true intent known until the last instant. Activity rules are essentially introduced to induce truthful bidding and facilitate price-discovery. There may be two types of activity rules:

**Quantity based**- to be a large bidder at the end of the auction a bidder must be a large bidder throughout the auction; whereby the bidder has to maintain his eligibility for bidding sufficiently large in subsequent rounds by bidding sufficiently large in the current rounds (based on quantity of spectrum) and thus retain his eligibility points (the lots he must be bidding on should be similar in value and weightage to his final lot). The initial eligibility points are based on the earnest deposit money. However, quantity based activity rule is susceptible to *parking strategies* (parking bids, to retain eligibility for bidding, on lots or circles which are not of actual interest to bidder but similar in quantity, value or weightage; as the case may be for spectrum or licenses respectively)

**Revealed preference based**- Cramton, Ausubel and Milgrom proposed this activity rule whereby consistency in bidding behaviour throughout the auction can be ensured. The intent is to require the bidder to bid in a manner consistent with his revealed preferences. For example, suppose there are 3 circles, A, B and C (all of relatively similar values and weightage), if a bidder is bidding for circles B and C in
the initial stages and then suddenly jumps to circle A in the last stage, this revealed preference is inconsistent with his bidding behaviour and hence he violates the activity rule.

Cramton found after conducting several simulations that the bidders bid on most profitable package with revealed preference and bid on the largest profitable package with the quantity based rule.

- **Common values vs. Private values- The Winner’s Curse Problem**
  
  Auctions are used precisely because the seller is unsure about the values that the bidders attach to the object being sold. The values may be same to all but not known or the values may be private (known to the bidder) and independent of other bidders’ values.  
  
  An issue that can depress bidding in some ascending auctions is the “winner’s curse”. This problem generates when the bidders have the same, or closely the same, actual value for the object, but they have different information about the actual value; this is the ‘common values’ (the ex-post value is common to all) case.  
  
  The winner’s curse reflects the danger that the winner of an auction is likely to be the party who has most greatly over-estimated the value of the prize. This knowledge of winner’s curse leads all bidders to bid cautiously (shade their bids), especially the weaker firms (small operators). The weaker firms should be extra cautious because they recognize that they are only likely to win when they have over-estimated the value by even more than usual. Therefore, given this scenario the advantaged firm can be less cautious. Since the winner’s curse affects weak firms much more than strong ones (and moreover the effect is self-reinforcing), the advantaged strong bidder win most of the time and because its rival plays extremely cautiously, it wins at a low price.  
  
  However, this problem is pertinent to common values case. Auctions where there bidders hold private values for the object, independent of other bidders’ valuation, this problem does not arise. In this case each bidder knows the value of the object to himself at the time of bidding and the knowledge of other bidders’ values would not affect the valuation of the object to any particular bidder.

- **Exposure problem**
  
  In simultaneous auctions without package bid, for a bidder having synergies for lots have only option of gathering those lots individually (by winning each such lot/circle individually). However, since the bidder is bidding on individual lots and there is a possibility that he will win some of the lots it needs for its business plan, but not all. This exposure to the risk of winning less than what the bidder needs or ending up with the unprofitable agglomeration (unwanted package) has adverse consequences on efficiency and is named as the exposure problem in literature.
COMPETITION ISSUES IN AUCTIONS

Ensuring competition in the sector is of prime importance in any allocation procedure. The various auction designs discussed in the previous chapter have important competition issues lying at its base. The Competition Act, 2002 was designed to prevent practices having adverse effects on competition, to promote and sustain competition in markets, to protect the interests of consumers and to ensure freedom of trade carried on by other participants in markets, in India. The fundamentals of competition law are economic in nature: What is the market within which a firm competes? Does a company enjoy market power? How do particular business practices or agreements affect competition? Will a merger lead to higher or lower prices? The answers to these questions lie in economic theory and concepts. In context of spectrum auction designing there are plenty of competition issues to be taken care of in order to name a design efficient. The questions of market structure are more important than informational issues on which orthodox auction theory focuses. Some competition issues may be design specific while others present in all scenarios may vary in their relative seriousness with respect to designs.

The following are the competition issues in auction designs:

- **Collusion and Bid rigging**
  The primary threat to the success of any auction design (in being transparent and ensuring competitiveness) is Collusion. There is always the risk with any design that participants may explicitly or tacitly collude to avoid bidding up prices. The extent of collusion possible varies with the auction format (This has been discussed in greater detail in the next chapter). Often the participants in the bidding process may take recourse to some signalling (signal by bid figures or press statements etc.) whereby the bidders tacitly collude and succeed in supressing the prices or they may get into credible collusive agreements (depends on the auction design and possibility of retaliation) of keeping the bids low or abstain from bidding in expectation of sharing the spoil later. This causes severe harm to competitive price discovery and efficiency. Bid rigging is a much wider concept and encompasses activities like collusion, bribing and other such practices mentioned in the Competition Act, 2002, India.

- **Entry Problem**
  The second major concern of practical auction design is to attract bidders, since an auction with too few bidders risks being unprofitable for the auctioneer (Bulow and Klemperer, 1996) and potentially inefficient. The format of the auction can very well determine whether incumbents can deter entrants from being involved in bidding procedure, or depress the bidding of rivals. Entry is of utmost importance to check concentration of power, help price discovery and encourage healthy competition in the bidding process. Again, depending on the auction format the entry and entry
deterrence possibilities vary (we compare various designs with respect to entry in the subsequent chapter).
High deposit fees, high reserve price, small amount of spectrum for sale/no. of licenses less than or equal to the number of incumbents, dominant incumbents (asymmetries between bidders) can be some reasons which can deter entry.

- **Predatory behaviour (abuse of dominance)**
  Often the effectiveness of an auction format as an efficient, competition friendly and transparent mechanism is greatly reduced to the threat of predation by dominant incumbents. A strong bidder also has an incentive to create a reputation for aggressiveness that reinforces its advantage. A bidder who buys assets that are complementary to assets for sale in a future auction or who simply bids very aggressively in early auctions can develop a reputation for aggressiveness (Bikhchandani, 1988). Potential rivals in future auctions will be less willing to participate and will bid less aggressively if they do participate. For example, before bidding for the California phone license, Pacific Telephone announced in the Wall Street Journal that “if somebody takes California away from us, they’ll never make money” - this could be interpreted as a threat of predatory pricing.

- **Mergers and acquisitions**
  A major concern in the competition law and a common phenomenon observed in auctions. Mergers and acquisitions may be either post-auction (takeovers and agreements after assignment through auctions) or pre-auction (mergers and acquisitions before the auction). Both of these activities are strategic in nature and may be detrimental to competition and change the market structure. In the Indian context, with reference to the telecommunication sector which comes under the purview of the competition authority and therefore the Competition Act, 2002- ‘Entering into a combination which causes or is likely to cause an appreciable adverse effect on competition within the relevant market in India is prohibited and such combination shall be void’. However auctions are prone to merger and acquisition concerns.

- **Associated bidding**
  Associated bidding is a competition issue (very similar to acquisitions) involved with auction designs. The problem arises when the ownership of the companies is sufficiently shared that both cannot be allowed to win licenses without damaging the competitiveness of the sector. For example, in the British 3G spectrum licenses auction case, Cellnet was jointly owned by BT and Securicor at that time such that not more than one of these firms could be permitted to win (in which case it would
distort the market structure). It is very difficult to model an auction design and rules which guarantees only one of any associated pair wins a license. However, Klemperer and Binmore (they designed the British 3G auction) came up with an idea of pre-auction designed to provide a clear status quo for bargaining between associated bidders when they sort out their cross-ownership problems themselves, but this causes disadvantages to associated bidders relative to other bidders so there is an incentive to sort out common ownership problem before the auction. In the example, BT bought out Securicor’s share of Cellnet and then bid only as BT3G, thereby resolving the associated bidding issue. This may not be the case always and associated bidding may feature as a concern in the auctions.

- **Secondary Trading**

Spectrum is a scarce natural resource and while designing its auction format one concern is whether secondary trading of spectrum should be allowed? Secondary trading has been a debatable issue in auction formats, while it is considered to increase efficiency in allocation by some it is criticised on grounds of manipulation of values by others. Secondary trading should always be aimed at ensuring efficiency such that the spectrum is assigned to those who value it the most and can make the best use of it. The proponents of secondary trading argue that any initial allocation for a sufficiently long time duration (20 years in Indian case) does not necessarily ensure that the spectrum will be used efficiently in the future. In particular, the initial allocation cannot stop the inevitable downstream shifts in the supply and demand for wireless services that drive the demand for spectrum. These short-run fluctuations and long-run shifts can create significant valuation differences between an initial licensee and a prospective future user of that spectrum. In this sense, government policy can ensure efficient spectrum use only if it defines the parameters under which secondary-market transactions can occur in addition to the parameters under which the spectrum is initially allocated. Well-functioning secondary markets can help ensure that, as demand and supply shift, spectrum will migrate to more efficient uses, including those by parties outside of the initial allocation.

- **Artificial scarcity**

At times when the revenue generation objective tries to supersede the efficiency and competition stimulation objectives for an auctioneer, he may resort to creating artificial scarcity. Artificial scarcity would hamper price discovery and cause inefficiency because the true prices will not be determined by the demand supply interaction (since supply would be artificially kept low). As such artificial scarcity or say with-holding of spectrum in auctions would cause inefficiency by artificially raising prices.

- **Rent seeking**
Rent seeking is a very relative issue associated with specific auction designs. Depending on the format of the auction, i.e. if the design is prone to inefficiency and there is scope for low value players to win the auction and then sell at a higher price any high value aspirant, winner can make rents in the process. Rent seeking through resale is possible if the latter process (resale procedure) is allowed. Thus, it is important for the design to preclude such possibilities so that the resource is allocated efficiently and competition goals are preserved.

- **Bid snipping and activity rules**

While studying auction designs and its competition friendliness, bid snipping concept is indispensable. Bid snipping is a strategy player by a bidder whereby he/she is able to keep his/her true preferences for a particular object in an auction (multiple-round auction) secret until the end. Considering a spectrum auction for various circles, when a bidder in a multiple round auction does not disclose his interest in bidding for a particular until the last round when he suddenly jumps into competition for that particular circle and bids highly for it, we name it bid snipping. This strategy of hiding interest for a particular object helps in keeping the final bid price low. Bid snipping violates transparency and consistency in bidding behaviour. Auction theorists designed activity rules to combat this problem (activity rules in particular auctions discussed in subsequent chapters). Activity rules may be quantity (of spectrum bid in each round) based or preference revelation (consistency requirement in bidding for particular circles) based (discussed in Cramton, 2012).

- **Reserve prices (sunk costs) and profitability**

The effect of reserve prices on competition has been discussed in the previous chapter. In brief the minimum amount which an item raises is the reserve prices. A revenue driven concept, it is set by the auctioneer. High reserve prices discourages entry (because entrants are already disadvantaged relative to incumbents and high reserve prices depresses their hopes of winning further, also they may get liquidity constrained in rolling out services after paying high sunk costs) whereas low reserve prices encourages collusion. It is important to note that the common man’s perception of high reserve prices and therefore high spectrum costs being passed on to consumer as higher tariffs is not seconded by economic theory. Spectrum costs form part of sunk costs and do not enter in the profit maximisation exercise.

- **Spectrum caps**

Spectrum caps are the ceiling on individual holding of spectrum or spectrum licenses (as the case may be) to prevent concentration of power. Spectrum caps are important to auction design and rules of a particular auction to check dominance, hoarding and rent-seeking activities. It helps in maintaining the competitive market structure in an otherwise susceptible to imperfect competition, market.
• **Pricing rule and demand reduction**

An extremely important feature in ensuring efficient price discovery is the pricing rule in the auction. A pay-as-bid rule, where the bidder pays his bid amount in case he wins, provides incentives for demand reduction such that by shading bids the bidder is able to keep the prices low (as demand becomes relatively small). This hampers efficient determination of prices by the market. Alternative pricing rule, discussed in Cramton, 2012, is the Vickery’s nearest core pricing rule which induces truthful bidding.

**REVENUE vs. EFFICIENCY DEBATE**

Spectrum auctions have been crucial to competition since it envisages two seemingly conflicting concepts: Revenue and Efficiency.

Auction of scarce resources such as spectrum is an attractive source of revenue for a government which otherwise depends on tax payments and deficit financing to meet its budgetary expenditure. However, if the sole objective is to raise revenue, then there arises the problem of inefficiency in allocation and use of the resource which in turn is welfare reducing. Provided properly designed and implemented, spectrum auctions should not create significant economic distortions.

The key point is that if a government does not concern itself about downstream competition in mobile service markets, then efficient allocation of spectrum and maximising revenue are diametrically opposing objectives. However, if that government operates under the constraint that it wants effective downstream competition then the objectives of efficient allocation and maximising revenue are closely, but not entirely, aligned.

Thus, provided measures are taken to promote effective downstream competition, the objectives of revenue maximization and efficient allocation of spectrum are largely aligned. In particular, efficient allocation of spectrum requires that licensees pay the opportunity cost of the spectrum they are awarded; in turn this entails raising some revenue as a by-product of efficient allocation (defined as the highest valued bidder winning). Ensuring that spectrum goes to whoever values it most is broadly compatible with obtaining the greatest revenue; indeed if spectrum did not go to high-value users, then revenue could not be maximised. However, this alignment is not perfect, as there are situations in which auction designs can be ‘tweaked’ to get a little more revenue at the expense of a small loss in efficiency. It is primarily in the case that competition for spectrum is weak that the objectives of revenue maximisation and efficient allocation may diverge.
COMPETITION BASED COMPARISONS OF VARIOUS AUCTION DESIGN

Till now we have been studying auction designs and competition issues separately, now we come to the most interesting part of this report which involves analysing the implications of various designs on competition. We study the various competition issues discussed in previous chapter with respect to the different auction designs defined previously. In the subsequent chapters we figure out certain auction designs in practice in several famous auctions. We will also analyse the Indian 3G auction and the recent recommendations by TRAI on conducting the 2G auctions.

One auction gives way to the other when it is out-weighed on efficiency and competitiveness terms by other auction designs.

According to Peter Cramton, there are three essential points associated with an efficient design: (a) Enhance substitution across items sold through product-design- what is auctioned, (b) Encourage price discovery accomplished by a dynamic process, (c) Induce truthful bidding through an effective pricing rule and an activity rule.

Before proceeding on specific designs let us contrast the broad formats, namely: Open-bid vs. Sealed-bid, Simultaneous vs. Sequential and Package bids (combinatorial) vs. Individual bids.

Open bidding vs. Single sealed bid

Information revelation is very important for efficient assignment of spectrum. An important advantage of open bidding in form of English, Dutch or Japanese auctions is that the bidding process reveals information about valuations and preferences, this information promotes efficiency in allocation since bidders can condition their bids on more information. Moreover it may help raise auction revenues (bidders can bid more aggressively with better information) to the extent the bidder values are affiliated since the winner’s curse is reduced. However, in the sealed bid mechanism these advantages are lacking since the bidders make their sole ‘best and final’ bid based on their expectation of valuations of other players and hence there are greater chances of inefficiencies either in the form of over-payment by the winner in case of first price sealed bid (if second highest bid is much less) or the normal valuation dilemma captured by winner’s curse problem.

Although, information is a concern but sealed bid wins over open bidding when it comes to collusion susceptibility. Open bidding allows bidders to signal their preferences for particular objects (licenses or circles in context of spectrum auction) and indulge in tacit collusion. The collusion is sustainable because there is the facility of punishment by retaliation in subsequent rounds (since multiple rounds exists as in repeated game concept), however...
sealed bid is less susceptible to collusion since there is no scope for retaliation for any deviation from collusion to make the tacit agreements enforceable.

When we take promotion of entry into consideration, sealed bid auctions are more likely to encourage entrants to participate in bidding. In open bid ascending auction strong incumbents can wipe out any initiative by the entrants by marginally overbidding the entrant’s bid whereas due to secrecy of bids in a sealed bid auction there are better chances of an entrant winning against strong incumbents. However, there is no price discovery in sealed bid format such that it lacks efficiency in valuation of scarce spectrum resources.

On practical grounds, it is very difficult to design an absolutely collusion proof auction such that based on informational advantages open bid auction gets priority over sealed bid.

**Simultaneous vs. Sequential auction**

When several objects are part of a single auction, in our context when spectrum licenses or spectrum is to be auctioned for several circles, the auction can be done in a sequential order for each object or license or bandwidth one at a time or all the units of licenses can be put to auction at the same time i.e. simultaneously. A disadvantage of sequential auctions is that they limit information to bidders and also restricts the ways the bidders can respond to the information. A sequential format eliminates many strategies. Since the objects are auctioned one at a time, the bidder is restricted to stick to his choice, he cannot move from a license in favour of another once he has won the former, thus rendering inflexibility to the format. With sequential format, bidders must guess what prices will be in future auctions when determining bids in the current auction. Bidders are likely to regret having purchased early at high prices, or not having purchased early at low prices. Thus, outcomes are likely to be less efficient than simultaneous auctions where all the objects are up for sale and bidding continues on all objects (licenses) until demand equals supply for all the objects or licenses or circles. Thus, bidders continue to gain information about prices on all the licenses as auction proceeds and therefore can switch among licenses based on this information. Moreover simultaneous auction format generates market prices since market for all the licenses are open for purchase and sale until demand equals supply for all the licenses. Hence, greater information release and greater bidding flexibility which are virtues of improved efficiency, associated with simultaneous auction convinces authorities to prefer simultaneous to sequential auction format.

**Package vs. Individual bids**

Sometimes a bidder’s value of a particular license may depend on what other licenses he has won or is expected to win. In case of spectrum licenses, the telecom company may value bidding on a combination of licenses for its desired circles much more than placing a number of individual bids on some of such licenses. Due to the presence of such synergies between objects, often multiple objects are clubbed into packages and auctioned
simultaneously (not sequentially because selling each object one by one would make the strategic behaviour of bidders, who hold synergies for combinations, more complex). Not allowing for such package bids may create inefficiencies. With individual bids, bidding for a synergistic combination may expose bidders to aggregation risks. The bidder may fail to acquire key pieces of licenses of the desired combination, but pay prices based on expected synergistic gain. Another alternate possibility is that the bidder may be forced to bid beyond his valuation to obtain the synergies and reduce its loss from being stuck with undesired, incomplete and inefficient package. This is known as the exposure problem in auction literature. Thus, although the creation of efficient combinations or package is complex, combinatorial auctions have been much widely used in many recent auctions.

Now we contrast various specific auction designs on the basis of their ability to ensure competition and deal with the various competition issues discussed in the previous chapter.

As considered in the comparison above we found that open bidding is more prone to collusion than sealed bid. Now we analyse various forms of open bid auctions and the competition issues related to them.
Comparative study of the Simultaneous Ascending Auction, Simultaneous Clock Auction and Combinatorial Clock auction

Single-object auctions are impractical in our spectrum auctions case therefore we concentrate on comparing multiple-objects auctioned simultaneously via the ascending auction procedure and via the clock auction procedure.

Simultaneous ascending auction was first introduced in US in 1994 has been a predominant method of auctioning spectrum. It has been viewed as an effective and simple price discovery process. It allows arbitrage across substitutes. It lets bidders piece together desirable packages of items. And, because of the dynamic process, it reduces the winner’s curse by revealing common value information during the auction (Kagel and Levin 1986, Kagel et al. 1996).

Despite such popularity, several design issues related to competition have surfaced- bidders’ use of trailing digits to signal other bidders and support tacit collusion. In such auctions bidders can use the early stages when prices are still low, to signal who should win (deals through signals in the language of bids) which objects and then tacitly agree to stop pushing up prices. On contrasting simultaneous ascending auction with simultaneous clock auction we find that clock auction is less susceptible to collusion by signalling strategies since here the auctioneer raises the bid by a predetermined amount and the players can only accept or reject it, so they cannot resort to signalling through bid amounts. The two critical differences between the clock auction and the simultaneous ascending auction are 1) the bidder only answers demand queries, stating the quantities desired at the announced prices, and 2) there is no need to determine provisionally winning bidders at the end of every round. Hence, the bidders neither can bid very aggressively no do they come to know about who is bidding for what to (for the purpose facilitating collusion with the concerned party), the bidders only come to know about the provisionally winning bids.

Also, as a result of the pricing rule, there is a strong incentive for large bidders to engage in demand reduction- to reduce the quantity demanded before the bidder’s marginal value is reached in order to win at low prices which in turn harms price discovery and efficiency. This feature of demand reduction is common to both formats since both are pay-as-bid type of design. A solution to this problem can be the Vickery’s nearest core pricing (see Appendix).

As we have noted below an important element of the basic design is an activity rule to address the problem of bid sniping—waiting until the last minute to bid seriously. The rule adopted by FCC in US auctions in this respect was a quantity-based activity rule, whereby a big bidder (in terms of licenses won or spectrum assigned) at the end of the auction has to remain a big bidder throughout the auction but as a result of this kind of quantity based activity rule bidders have developed parking strategies- A bidder maintains activity requirement and eligibility by parking his bids on particular items or circles, which are
similar in value or weightage, that the bidder is not interested in and then moves to his true interest later. Again activity rules mechanism is common to both types of designs.

The simultaneous ascending auction is typically done without package bids. The bidders are bidding on individual lots and there is the possibility that a bidder will win some of the lots that it needs for its business plan, but not all. This exposure to winning less than what the bidder needs has adverse consequences on efficiency. Therefore this design is subject to exposure problem which leads to gross inefficiency in allocation. Exposure problem is also common to both of the designs, simultaneous ascending and simultaneous clock auction. A solution to exposure problem is to employ the combinatorial clock auction mechanism which while retaining the advantages of clock auction provides the benefits of package bids and hence reduces exposure risks.

Another crucial area of concern is to promote entry and competition, i.e. attract bidders since an auction with too few bidders is likely to lead to concentration of power as well as unprofitable for the auctioneer. Ascending auctions are particularly poor in this respect since they can allow some bidders to deter entry, or depress the bidding, of rivals. An example of the problem was the sale of the Los Angeles licence in the big American telecom auction run by the FCC. The license was acquired cheaply by the incumbent, Pacific Bell, which faced little risk in implementing its widely advertised strategy of not being beaten in Los Angeles. All it had to do was to persistently make the minimum overbid if an entrant challenged, until the entrant gave up the hopeless struggle (Klemperer, 1998). Moreover, if in an ascending bid auction the number of licenses to be auction is less than or equal to the number of incumbents, entry gets discouraged because the incumbents are as it is in an advantageous position, with respect to established networks, brand name, initial spectrum, and thus can easily over-bid and win.

Since outcomes in an ascending auction can be theatrically influenced by a seemingly modest advantage, developing such advantage can be an effective predatory strategy. Predation is particularly easy in repeated ascending auctions, for example a series of spectrum auctions.

Inadequate reserve prices in an ascending auction also increase the incentives for predation and may encourage collusion which would not otherwise be in all bidders’ interests. A strong bidder in an ascending auction has a choice between either tacitly colluding to end the auction at low prices or forcing the bid up to drive out weaker bidders. The lower the reserve price at which auction can be concluded, the more attractive is the first option (Klemperer, 2002). However, high reserve prices are also a concern because they can discourage entrants from participating in the auction.

Cramton (2012) has strongly advocated combinatorial clock auction emphasising that the design eliminates the exposure problem, it eliminates most gaming behaviour, it enhances substitution, and it encourages competition. This design inculcates the advantages of usual
clock auction over simultaneous ascending as well as provides scope for exploiting synergies by package bidding.

Therefore we may conclude that simultaneous ascending auctions can always be improved by turning it into simultaneous clock auction, which is less susceptible to collusion and predation retaining all the informational advantages and is very widely used design in the present day e-auctions. Clock auctions are highly transparent, encourages price discovery and enhances competition. Further in order to do away with exposure problem in markets where there exists strong synergies and complementarities across lots, combinatorial clock auction is best suited.
ANALYSIS OF THE VARIOUS AUCTION FORMATS PRACTICED IN INDIA AND ABROAD- With Reference To The New 2G Recommendations.

Time and again there have been debates among economists on the use of auction formats and their effect on the resultant assignment of spectrum. Different nations have employed various experts in the field of auction theory to design for them the best auction format, in terms of efficiency, transparency and revenue generation. The idea is that there is no one unanimously agreed upon ‘master’ format since the result of any auction design depends on the relative situation it is applied to. As countries differ in their economic and market structure, their policies of assignment and liberalisation, the auction format which best suits one nation may be a complete disaster for some other nation with a different market structure and policies. In the words of Klemperer auction design is not ‘one size fits all’. In this chapter we analyse the different auction designs used in some of the biggest and most popular auctions of the world, then we also consider the Indian 3G auction design, further we analyse the recent recommendations made by TRAI (as per the Supreme Court verdict) for the 2G auction.

The British 3G Licenses Auction, 2000

Binmore and Klemperer were the two auction theorists designated with the job of designing the British 3G licenses auction which concluded on 27 April 2000. It was named as “The Biggest Auction Ever” by them for it raised a phenomenal £22.5 billion. Initially the market structure was such that there were four incumbents and only four licenses were to be auctioned; the major problem in this scenario was to promote entry. However, since entry was the concern, ascending-price auction could not be relied upon (entry problem with ascending-price auction is discussed in previous chapters). There were numerous examples of previous fiascos in which there were no more bidders than licenses, such that the auction did not serve competition goals. Sealed-bid was also ruled out due to its information niggardliness. Hence the duo came up with a new design the Anglo-Dutch auction which inherited the desirable features of both ascending auction and sealed-bid. Under this format as discussed in detail in previous chapters the auction was ascending in nature until the last stage where the number of bidders exceeded the number of licenses by just one, when the remaining bidders were supposed to submit their ‘best and final’ bid for the last round. The lowest bid was to be dropped and the remaining bidders were to be allocated the licenses. However this design faced severe criticisms from the incumbents who could not be expected to welcome a design promoting entry. Later, it was possible to device five licenses instead of four such that the Anglo-Dutch design could easily be replaced by the Simultaneous Ascending auction.
UK Spectrum Auctions, since 2006

The need for a technology neutral auction is commonplace in today’s world of rapidly developing communications technologies and applications. Although the regulator can typically identify the viable candidate technologies based on early development, the regulator cannot decide how available spectrum should be split among the technologies without a market test. Ofcom, the independent regulator and competition authority for the UK communications industries, was the first to recognize and act on this need for a technology neutral auction. In spring 2006, Larry Ausubel and Peter Cramton proposed to Ofcom a version of the combinatorial clock auction.

Ofcom has three main goals for the auction design. The auction should be technology neutral, allowing alternative viable technologies to compete for the spectrum on an equal basis. The auction should accommodate flexible spectrum usage rights, permitting the user to decide how the spectrum would be used, subject to minimizing interference externalities with neighbours. And the auction should promote an efficient assignment of the spectrum, putting the spectrum to its best use.

Simplicity and transparency are important secondary objectives. On simplicity, Ofcom recognized that satisfying the main objectives posed serious challenges, which could not be addressed with an auction design that is too simple. For example, the simultaneous ascending auction has simple rules, but incredibly complicated bidding strategies. In contrast, the combinatorial clock auction has more complex rules, but the rules have been carefully constructed to make participation especially easy. For the most part, the bidder can focus simply on determining its true preferences for packages it can realistically expect to win. In a combinatorial clock auction it is the auctioneer that needs to do the complex optimization, whereas the bidders can focus on their values for realistic packages.

Revenue maximization was explicitly excluded as an objective. According to Cramton (2012) nonetheless, an efficient auction necessarily will generate substantial revenues. Indeed, his advice to countries is to focus on efficiency. A focus on revenues is short-sighted when accomplished with help of artificial scarcity. In his view, the government is better off finding as much spectrum as possible and then auctioning it so as to put the spectrum to its best use. This approach would create a competitive and innovative market for communications, which has substantial positive spillovers to the rest of the economy. Under this approach, long-term revenues likely will far exceed those that would come from the maximization of short-term auction revenues. Thus the essence of Cramton’s argument is that generating revenues by creating artificial scarcity is harmful, ant-competitive and inefficient.

(Combinatorial clock auctions discussed in detail in Cramton, 2012)
The Indian Experience

India has recently (from 2010) taken to auctions for allotment of 3G spectrum licenses. Prior to this, the assignment was made through administrative processes like beauty contests, lotteries and FCFS. The prices were decided by government in each of the cases so we learn that there was no price discovery mechanism to decipher efficient market prices. The weakness of the previous mechanism and its vulnerability to corruption is an established fact after the Supreme Court verdict in February, 2012 which recognised the FCFS method of allotment of 2G licenses as arbitrary and deliberately designed to favour certain undeserving candidates. The apex court cancelled all the 122 licenses which were distributed in 2010 and ordered the regulatory authority to make fresh recommendations to the Department of Telecommunication for the assignment of spectrum (but delinked spectrum from licenses, unlike 3G) through auctions, as has been done in the 3G licenses case.

India’s auction for 3G GSM Service licence ended on 9th April 2010 after 34 days of intense bidding and 183 rounds with the Government of India generating revenue of around Rs. 70,000 crore. The government auctioned three slots of licenses in 17 telecom service areas and four slots in the remaining five states of Punjab, Bihar, Orissa, Jammu and Kashmir and Himachal Pradesh (which makes a total of 71 licenses in 22 service areas). No single bidder bid for a pan-India 3G license so state operator BSNL remains the biggest 3G operator in India. The following table provides an insight to the distribution of licenses and the revenue generated.
The Indian design for the auction of 3G spectrum licenses is called the **Simultaneous Multiple Round Auction (SMRA)**. It has been designed keeping in mind the clock auction. Now, let us analyse the Indian 3G auction format.

- Objectives for the award process were:
  - Award spectrum transparently and fairly
  - Promote efficient use of spectrum
    - Stimulate competition
    - Encourage roll-out
  - Ensure effective competition for spectrum
  - Generate revenue for public purse.

Hence the primary criterion was to ensure efficiency, second in priority was to promote competition (tackle collusion and concentration) and the third concern was revenue generation.

- The auction was giving out 3 or 4 blocks of 2x5MHz in the 2.1GHz band for 22 service areas for the 3G use and 2 blocks of 20MHz in the 2.3GHz band for 22 service areas for the BWA use.

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<td>30.3</td>
<td>30.3</td>
<td>113.10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,499.46</strong></td>
<td><strong>12,295.46</strong></td>
<td><strong>5,768.39</strong></td>
<td><strong>8,585.04</strong></td>
<td><strong>337.67</strong></td>
<td><strong>5,864.29</strong></td>
<td><strong>11,617.86</strong></td>
<td><strong>50,988.37</strong></td>
</tr>
</tbody>
</table>

The results of India’s 3G Spectrum Auction are provided in the table above.
• The auction procedure was implemented through *Electronic Auction System* (EAS) was to be run online over a secured website, access to the server was authenticated by digital certificates.

• The format consisted of a two stage process of allocating the lots among the bidders-the first being the *clock phase* and second the *assignment phase (frequency identification phase)*.

In the **first** phase, which is modelled on the Simultaneous Clock Auction, the auctioneer begins by setting the clock prices to the reserve price for each of the 22 telecom circles for which the licenses are being auctioned (there is one clock for each telecom circle). The bidders are expected to indicate in a 1/0 format their demand for lots in the desired circles at the prevalent clock prices. In case the demand for lots exceeds the supply in a given circle, the clock prices are then increased relative to the previous round clock price according to a pre-specified formula. At the end of each round provisionally winning bids were declared. The clock round continues simultaneously and independently in every circle (all service areas remain in play till the end) till the demand is no more than the number of available lots in every service area and the activity level reached 100%

The bidders were required to maintain certain activity level in each round based on the eligibility point system so as to qualify for bidding in the subsequent rounds (the activity level tightens as the auction proceeds to higher rounds).

In the **second** phase i.e. the frequency identification stage specific frequencies available to Winning bidders are identified. The frequencies identified were to be announced simultaneous with the outcome of Auction of 3G and BWA Spectrum – Notice Inviting Applications the Clock Stage. The initial identification of the frequencies was to be performed automatically by the Electronic Auction System through a random allocation mechanism.

• A few pros and cons of the design which are as under:

  ➢ Since it’s a multiple round clock auction *predatory jump bidding is not possible*

  ➢ Restricting the bids to quantity bids at specified clock prices and nondisclosure of identity of provisional winners (bidders can only know the total demand in each area, not who is bidding for what), the possibility of use of *collusive and retaliatory strategies has been precluded*. By limiting the release of information to the excess demand at the end of each clock round and eliminating the need for disclosing the identities of the provisionally winning bidders, an effective trade-off between releasing sufficient information to aid the *price discovery process* and prevent collusion/retaliation has been achieved.

  ➢ Activity rules (implemented through the eligibility point system) aimed at avoiding ‘bid snipping’ does not prevent the bidders from employing *parking strategies* to hide their intent until the late stages thereby impeding the process of price discovery. The reason is that the quantity based activity rule in simultaneous ascending auctions which entails a big bidder at the end of
the auction to be a big bidder throughout does not take into account that the bidder may retain his eligibility to bid by just sitting on an area with weightage similar to his area of interest. For example, a bidder may retain his eligibility to bid for, say Delhi Circle, by submitting parking bids for the eligibility-wise equivalent Mumbai circle, till such time he feels that the auction for the Delhi circle is reaching the final stage, at which moment the bidder can switch without any cost. Thus parking strategy permits bidders to hide their true bidding intent from their rivals and inhibits the revelation of common value information so critical to the price discovery process.

- Then there issue of substitutability across lots. Since the auction design is a two stage one- with the first merely settling the question of who wins how much in each area at what price, before assignment of actual frequencies in the second, lots on auction during the first phase are generic (perfect substitutes). As such, the auctioneer is assured that identical licenses would bring similar payments. It also simplifies the bidding strategies; since the bidder focus their attention on licenses rather than particular combination of frequencies to be allocated.

- Fourth, since the format of auction in the clock phase is quite similar to the Simultaneous Ascending auction, bidding for packages would necessarily involve guesses regarding the final prices of complementary licenses. Therefore the auction design does no better than Simultaneous Ascending auction in reducing the exposure of the bidders to agglomeration risks, i.e. the exposure problem stays.

- The pricing rule of the Indian 3G SMRA format is similar to that in a SA auction, i.e. bidders face the pay as bid pricing incentive and as such there lies the problem of demand reduction. Hence, the bidders tend to shade their bids by reducing the quantity demanded, i.e. they reduce the quantity demanded to win at lower prices. When this practice is possible after fulfilling the activity requirement, we may say that it harms the efficiency of the process.

- One of the most important competition issues being entry and post-auction market structure. In an open auction format such as the 3G auction format adopted by India, it is difficult to attract entrants since they participate in the auction with a relative disadvantage against the existing 2G incumbents with their existing customer bases, established brand names and lower cost of rolling out network (as they can ride on the existing 2G infrastructure). Inability to attract sufficient number of entrants results in the incumbents dividing the licenses amongst themselves and lower revenue realization from the auction. In India’s case, the number of licenses on offer (between 3 and 4) is much lower than the number of incumbents (approx. 7). Furthermore, the entrant faces another source of competitive disadvantage against the incumbent (who enjoy a 2x4.4 MHz spectrum which came bundled with their 2G licenses and was allocated at less than market determined cost). While mitigating provisions like operationalizing MNP Regime to lower switching cost for consumers, sharing of infrastructure and permission for 100% Foreign Ownership have been made, they may not be encouraging enough
for a potential entrant. However, by international yardsticks, India has comparatively far larger number of incumbent operators. Given that the current Herfindahl-Hirschman Index (HHI) for mobile telephone industry at the national level is around 0.2136 (GoI 2009), the market does not appear to be unduly concentrated. Even at the circle level, the HHIs are below 0.25 on an average.

Thus, we find certain appreciable features from the competition point of view in the 3G auction design which includes prevention of collusive and predatory bidding strategies, and substitution among licenses. However, there is scope of improvement in the pricing rule for increasing the expected revenue; also promotion of entry has taken a back-seat in the design.

Before analysing the TRAI recommendations for the forthcoming 2G spectrum auctions let us have a brief look at the history of 2G spectrum allocations.

- In 2008, the then telecom minister allotted the 2G licenses on a FCFS basis.
- There was no cap on the allotment
- Soon after obtaining the LoIs, 3 of the successful applicants offloaded their stakes for thousands of crores in the name of infusing equity, they are:
  
  (i) Swan Telecom Capital Pvt. Ltd. (now known as Etisalat DB Telecom Pvt. Ltd.) got UAS Licence by paying licence fee of Rs. 1537 crores offloaded its 45% (approximate) equity in favour of Etisalat of UAE for over Rs.3,544 crores.
(ii) Unitech which had obtained licence for Rs.1651 crores offloaded its stake 60% equity in favour of Telenor Asia Pte. Ltd., a part of Telenor Group (Norway) in the name of issue of fresh equity shares for Rs.6120 crores

(iii) Tata Tele Services transferred 27.31% of equity worth Rs. 12,924 crores in favour of NTT DOCOMO.

(iv) Tata Tele Services (Maharashtra) transferred 20.25% equity of the value of Rs.949 crores in favour of NTT DOCOMO.

- The audit report of Comptroller and Auditor General of India (CAG) says that several licenses were issued to firms with no prior experience in the telecom sector or were ineligible or had suppressed relevant facts
- The Supreme Court verdict declared “The exercise undertaken by the officers of the DoT between September, 2007 and March 2008, under the leadership of the then Minister of C&IT was wholly arbitrary, capricious and contrary to public interest apart from violating of the doctrine of equality. The material produced before the Court shows that the Minister of C&IT wanted to favour some companies at the cost of the Public Exchequer”. The allotment was declared as “wholly arbitrary and unconstitutional action”
- The Judgement came on 2\textsuperscript{nd} February, 2012 as “The licences granted to the private respondents on or after 10.1.2008 pursuant to two press releases issued on 10.1.2008 and subsequent allocation of spectrum to the licensees are declared illegal and are quashed”. All of those 122 licenses stand cancelled.
- The apex court ordered TRAI to make fresh recommendations to the Central Government for the grant of license and allocation of spectrum in the 2G band, and also ordered that fresh licenses be awarded through auction.

Therefore, The Telecom Regulatory Authority of India (TRAI) released its Recommendations on Auction of Spectrum on 23\textsuperscript{rd} April, 2012. The recommendations invited large scale controversy and debates with respect to various clauses. The industry, press and media, the DoT and TRAI are active participants of the uproar.

Prior to the release of recommendations for spectrum auctions by TRAI there were several important decisions by DoT were:

(i) In future, the spectrum will not be bundled with the licence. The licence to be issued to telecom operators will be in nature of ‘unified licence’. In the event the licence holder would like to offer wireless services, it will have to obtain spectrum through a market driven process. There will not be any concept of start-up spectrum in future.

(ii) No more UAS licences linked with spectrum will be awarded.
(iii) All future licences will be Unified Licences and allocation of spectrum will be delinked from the licence. Spectrum, if required, will have to be obtained separately.

(iv) The need for re-farming of spectrum is accepted in-principle.

(v) Spectrum trading will not be allowed in India, at this stage. This will be re-examined at a later date.

The following is the summary of spectrum availability range in various circles released in TRAI’s consultation paper for spectrum auctions

### Table 1.4 Summary of Spectrum Availability

<table>
<thead>
<tr>
<th>Band</th>
<th>Spectrum Availability (Range in MHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>700 MHz</td>
<td>2x45</td>
</tr>
<tr>
<td>800 MHz</td>
<td>0-12.5</td>
</tr>
<tr>
<td>900 MHz</td>
<td>Nil</td>
</tr>
<tr>
<td>1800 MHz</td>
<td>3.2-47.4</td>
</tr>
<tr>
<td>2.3.-2.4 GHz</td>
<td>0-20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Band</th>
<th>Net Total Spectrum Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>700MHz</td>
<td>2x45</td>
</tr>
<tr>
<td>800MHz</td>
<td>137.5</td>
</tr>
<tr>
<td>900MHz</td>
<td>Nil</td>
</tr>
<tr>
<td>1800MHz</td>
<td>413(due to cancellation)/ 624.6 (total available including partial assgn.)</td>
</tr>
<tr>
<td>2.3-2.4GHz</td>
<td>290</td>
</tr>
</tbody>
</table>
Now, let us analyse from the competition point of view the main points of the recommendations (and the controversies attached to them) regarding the auction design and procedure.

- **The Authority recommended liberalisation of all spectrum to assigned through the auction process, spectrum in any band can be used for deploying any services in any technology**
  - This step is welcomed well by the industry as now excess of spectrum in one use can be efficiently put to a different use where it is scarce. This will ensure optimal and efficient utilisation of the scarce natural resource.

- The authority recommended the following design and structure for auction of spectrum:
  - **The auction of spectrum shall be conducted using Simultaneous Multiple Round Auction (SMRA) format.**
    - This is the same format which was applied to the 3G spectrum licenses auction in 2010; hence the pros and cons of the format as discussed previously apply in this case also.
  - **Every auction shall be open to all those holding CMTS licence/ UAS licence / Unified licence or eligible for grant of Unified Licence. Auction shall not be open to those that hold spectrum above the prescribed cap.**
    - This is roughly the eligibility requirement; the auction is not restricted to only those players who lost the 122 licenses in total because of cancellation, neither does the auction prevent such players who under scrutiny for influencing the 2008 allocation from participating nor are the incumbents already in the 2G market holding spectrum below the cap prevented from participating.
  - **The limit for acquisition of spectrum shall be 50% of the spectrum assigned in each band in the respective service area and 25% of the total spectrum assigned in all bands put together in each service area**
    - The cap is required to avoid concentration of economic power and spectrum hoarding in the industry.
  - **In all auctions at least 5 MHz of spectrum shall be offered, except where the spectrum available is less than 5 MHz**
  - **Spectrum shall be offered in blocks of 1.25 MHz each.**
- The amount of 5 MHz was fixed since this is the minimum to ensure that any technology can be deployed on the allocated spectrum in the liberalised spectrum regime.
- However the block size is fixed keeping in mind the needs of the operators: In case an operator’s requirement is below 5 MHz or an incumbent cannot acquire full 5 MHz due to cap, hence 1.25 MHz of block size seems to serve the purpose.

- **The Authority recommended that with respect to auctions in 800 MHz and 1800 MHz band only an amount of 5 MHz be put to auction in all service areas**
  - This recommendation invites criticism on grounds of creating *artificial scarcity*. The total amount of available spectrum (given in the table in this chapter) is greater in 800 MHz (being 137.5 MHz in total for all 22 areas) and much greater in 1800 MHz (where net available is about 630 MHz).
  - This miserliness can be viewed as a revenue maximizing strategy by the authority; since if demand is greater than the supply, prices will rise, also much can be raised by making the remaining available in future such auctions.
  - However, it is to be borne in mind that the primary objective is *efficiency* and secondary objective is *revenue generation*. Artificial scarcity will cause inefficiency.
  - However the **Telecom Commission** have later decided to **increase the amount of available spectrum for auction to 10 MHz**.

- **Reserve price per MHz was calculated for 1800 MHz bandwidth as:**

(Average PLR 12.63% of 2010-11 * 1.2 * 0.8)

The justification behind the figures in the formula are summarised in the following arguments:

- The 3G spectrum was in the 2100 MHz band. The next auction will be in the 1800 MHz band. TRAI has opined that the 1800 MHz band is 1.2 times more efficient than the 2100 MHz band. Quoting Analysys Mason, a research and consulting outfit in the telecom, media and technology sectors, TRAI has said that 0.037 base stations are required in every square kilometre of suburban area and 0.018 stations in remote/rural areas in the 2100 MHz band, compared to 0.027 and 0.013, respectively, in the 1800 MHz band. In the 1800 MHz band, the cell range is 0.558 km in urban areas, 0.918 km in suburban areas and 10.949 km in rural areas, while the range is 0.470 km, 0.772 km and 9.753 km, respectively, in the 2100 MHz band. Hence, the reserve price (indexed to SBI’s PLR) was raised by a factor of 1.2. (source: economic times)
Having studied the various auctions held globally in the last three to four years, where showed that the reserve prices are generally around 0.5 times the final prices. In “the context of Indian telecom sector, where the demand for spectrum is considerably higher”, TRAI decided to use a factor of 0.8 to determine the reserve price.

This multiplicative factor of 0.8 has been greatly criticised by the telecom operators. It is accused of producing a cascading effect on the industry by them.

The following table provides a summary of the reserve prices

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Licence Service Area</th>
<th>700 MHz</th>
<th>800 MHz</th>
<th>900 MHz</th>
<th>1800 MHz</th>
<th>2100 MHz</th>
<th>2300 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Delhi</td>
<td>2869.04</td>
<td>1434.52</td>
<td>1434.52</td>
<td>717.26</td>
<td>747.17</td>
<td>126.20</td>
</tr>
<tr>
<td>2</td>
<td>Mumbai</td>
<td>2808.56</td>
<td>1404.28</td>
<td>1404.28</td>
<td>702.14</td>
<td>731.43</td>
<td>129.13</td>
</tr>
<tr>
<td>3</td>
<td>Kolkata</td>
<td>470.76</td>
<td>235.38</td>
<td>235.38</td>
<td>117.69</td>
<td>122.60</td>
<td>29.46</td>
</tr>
<tr>
<td>4</td>
<td>Maharashtra</td>
<td>1087.96</td>
<td>543.98</td>
<td>543.98</td>
<td>271.99</td>
<td>283.34</td>
<td>51.56</td>
</tr>
<tr>
<td>5</td>
<td>Gujarat</td>
<td>930.76</td>
<td>465.38</td>
<td>465.38</td>
<td>232.69</td>
<td>242.39</td>
<td>34.57</td>
</tr>
<tr>
<td>6</td>
<td>AP</td>
<td>1187.72</td>
<td>593.86</td>
<td>593.86</td>
<td>296.93</td>
<td>309.31</td>
<td>59.64</td>
</tr>
<tr>
<td>7</td>
<td>Karnataka</td>
<td>1366.56</td>
<td>683.28</td>
<td>683.28</td>
<td>341.64</td>
<td>355.89</td>
<td>86.91</td>
</tr>
<tr>
<td>8</td>
<td>Tamil Nadu</td>
<td>1267.12</td>
<td>633.56</td>
<td>633.56</td>
<td>316.78</td>
<td>329.99</td>
<td>116.54</td>
</tr>
<tr>
<td>9</td>
<td>Kerala</td>
<td>270.32</td>
<td>135.16</td>
<td>135.16</td>
<td>67.58</td>
<td>70.39</td>
<td>14.57</td>
</tr>
<tr>
<td>10</td>
<td>Punjab</td>
<td>278.52</td>
<td>139.26</td>
<td>139.26</td>
<td>69.63</td>
<td>72.54</td>
<td>18.71</td>
</tr>
<tr>
<td>11</td>
<td>Haryana</td>
<td>192.56</td>
<td>96.28</td>
<td>96.28</td>
<td>48.14</td>
<td>50.14</td>
<td>6.75</td>
</tr>
<tr>
<td>12</td>
<td>UP - West</td>
<td>444.64</td>
<td>222.32</td>
<td>222.32</td>
<td>111.16</td>
<td>115.79</td>
<td>10.35</td>
</tr>
<tr>
<td>13</td>
<td>UP - East</td>
<td>315.32</td>
<td>157.66</td>
<td>157.66</td>
<td>78.83</td>
<td>82.12</td>
<td>8.02</td>
</tr>
<tr>
<td>14</td>
<td>Rajasthan</td>
<td>277.68</td>
<td>138.84</td>
<td>138.84</td>
<td>69.42</td>
<td>72.32</td>
<td>5.48</td>
</tr>
<tr>
<td>15</td>
<td>M.P.</td>
<td>223.48</td>
<td>111.74</td>
<td>111.74</td>
<td>55.87</td>
<td>58.20</td>
<td>7.02</td>
</tr>
</tbody>
</table>

The recommendations on reserve prices generated maximum controversy, it invited mixed opinions from media and economists as well as severe criticisms from the telecom operators.
- Following are the arguments placed by the companies:

<table>
<thead>
<tr>
<th>TELECOM COMPANY</th>
<th>STATEMENT IN PRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunil Bharti Mittal, Chairman and Managing Director of Bharti Airtel</td>
<td>“...this industry is vital for the nation and the TRAI recommendations could spell the death knell for the industry,”</td>
</tr>
<tr>
<td>Jon Fredrik Baksaas, CEO of Telenor</td>
<td>the auction policy should be catalyst for “affordability, competition and investments” rather than leading to tariff hikes as would be the case with TRAI setting a high base price for the auction.</td>
</tr>
<tr>
<td>Kumar Mangalam Birla, Chairman, Idea Cellular</td>
<td>“If the decisions are taken in the interest of the industry, they (TRAI recommendations) have to be changed. I think the current recommendations will kill the industry, The subscriber will definitely pay much higher tariff if this is the kind of reserve price (accepted by the government),”</td>
</tr>
<tr>
<td>Vodafone</td>
<td>“We believe that several of these recommendations are retrograde and if accepted, will do irreparable harm to the industry.”</td>
</tr>
<tr>
<td>Uninor</td>
<td>The reserve price set by TRAI is high enough to discourage entry of small players</td>
</tr>
</tbody>
</table>

Source: The Hindu

- As we have discussed in chapter 2 reserve prices play a significant role in the auction design since it can lead to conflict between revenue and efficiency. Setting the optimal reserve price is very important since if it is too low, the design is ineffective because this encourages collusion and if the reserve prices are too high it may risk the object left unsold. The optimal reserve price calculations are based on the distribution of valuation of the bidders.

- However it is very difficult to determine this opportunity cost ex-ante and so is calculating optimal reserve price. There are certain clarifications required regarding all the arguments given with respect to reserve prices:

(i) The perception that investment costs in obtaining spectrum will result in higher consumer tariffs is a myth because spectrum costs as captured by the reserve prices (minimum spectrum cost) also, form part of the sunk costs (costs which cannot be recovered) and therefore does not enter in the profit maximizing calculations for
setting of profit tariffs. Thus, the argument that it will be passed to consumers does not hold ground in this sense. However, the interest payments for funding such spectrum costs do enter into the profit and loss account statement.

(ii) However, sustainability is risked with very high sunk costs since very high reserve prices would imply high resultant costs of spectrum which may cause liquidity problems for rolling out services and hamper the sustainability of firms.

(iii) High reserve prices affect entry adversely because entrants already fall in the disadvantaged group relative to incumbents with respect to setting up of infrastructure, obtaining resources for rolling out services, and as such additional burden of high sunk costs discourages entry.

(iv) The concept of reserve price in auctions takes its birth from the revenue generation objective. The press reports by experts and other stakeholders allege the reserve price recommended by TRAI as actually unsustainably high and entry deterring.

(v) These kind of high reserve prices are revenue driven and possess potential threat to competition by distorting the market structure (since it discourages entry, so only a few big players would participate in bidding which will be inefficient from competition point of view).

- The Authority recommended a scheme of deferred payments (schedule below), the payments being duly scrutinised and the Net Present Value be safeguarded by imposing a suitable rate of interest and also advised that mortgage of spectrum be allowed to registered Indian Financial Institutions (one of event of default the spectrum shall be auctioned).

<table>
<thead>
<tr>
<th>Spectrum</th>
<th>Initial Payment</th>
<th>Moratorium</th>
<th>Period for balance payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supra-1 GHz (1800,2100 and 2300 MHz bands)</td>
<td>33% of the Bid amount</td>
<td>2 years</td>
<td>10 years (equal annual instalments)</td>
</tr>
<tr>
<td>Sub-1 GHz bands (700,800 and 900 MHz bands)</td>
<td>25% of the Bid amount</td>
<td>2 years</td>
<td>10 years (equal annual instalments)</td>
</tr>
</tbody>
</table>
The Authority also recommended that the Department of Telecommunications must take up with the Ministry of Finance and the Reserve Bank of India to remove all the road blocks in the framework for borrowings by the telecom sector against the spectrum assigned to them.

- Thus, the common allegation by the telecom operators of liquidity problem in rolling out services due to heavy sunk costs does not make much sense in this scenario since the clauses provide ample scope for loans.
- Ease in obtaining funds improves the efficiency of the allocation mechanism.

The Authority recommended that Spectrum trading should be allowed between spectrum holders having obtained spectrum through auction or having paid the auction determined price for the spectrum held by them, only for the limited purpose of frequency configuration (arranging spectrum in a contiguous band).

- Thus, we find that that secondary trading of spectrum has not been encouraged by TRAI, Secondary trading of spectrum, or simply “Spectrum Trading” permits the purchaser to change the use to which the spectrum was initially put while maintaining the right to use. It may also entail change of ownership with no change of use. In the recommendation trading has been limited to operators already possessing some spectrum through the auction or having paid the auction determined price only for the purpose of frequency configuration.
- There was concern raised as to whether allow for change in assignment or change in allocation or both.
- As we have learnt from our previous discussions secondary trading is an important phenomenon in countries like UK and US where spectrum is assigned through the market mechanism, i.e. auctions, it helps in improving efficiency by transfers from those who have excess to those who have scarce.
- However, the class of arguments given by TRAI in 2010 in this matter was “… presently, the amount of spectrum available is limited and there is a restriction that no licensee can acquire more than one block of spectrum either in auction or subsequently through M&A. As such allowing trading in these bands will be premature and may not be of any benefit to the industry.”
- The validity period of the spectrum assigned in the Indian case will be 20 years, it’s a sufficiently long time and regardless of whether initial spectrum is allocated by comparative hearing, lottery or auction, any initial allocation does not necessarily ensure that the spectrum will be used efficiently in the future. Well-functioning secondary markets can help ensure that, as demand
and supply shift, spectrum will migrate to more efficient uses, including those by parties outside of the initial allocation.

- Also given there is a cap on spectrum holding and significant M&A restrictions in the present scenario as compared to the 2010 3G auctions (when there was no cap and secondary trading was discouraged on grounds of competition threats), the limitations on spectrum trading can be considerably relaxed.

Thus, having gone through the proposed auction format, assignment rules, the controversy over reserve prices and tariff hikes and the already gathered knowledge about designs and concepts, we are well equipped to comment on the competition enhancing and depressing features of the recommendations.

The summary of the arguments affecting competition are as under:

- The spectrum has been liberalised for deploying any technology on it which is a good signal of promoting efficiency in use.
- The format of the auction resembles the simultaneous clock auction format (here it’s a two stage format). Being a multiple-round clock formant predatory bidding is reduced. Since it’s a variant of the clock auction where the identities of the provisional winners are not disclosed only the net demand and supply difference is known, the chances of collusion in bidding is greatly reduced and as it is open-bid price discovery is promoted.
- Although a quantity-based activity rule is imposed (implemented through eligibility points initially determined by earnest deposit money), there remains scope for gaming behaviour and parking strategies to hide true intentions. Quantity based activity rule should be improved upon by revealed preference based activity rule to promote efficient price discovery and induce truthful bidding.
- Entry has not been given sufficient importance in the design.
- The recommended amount of not more than 5 MHz spectrum to be offered can be criticised on creating artificial scarcity, with-holding of spectrum is driven by revenue maximising objective of the authority.
- The multiplicative factor of 0.8 for the calculation of reserve price is viewed as high by the telecom operators, and it is unanimously advocated by them that higher reserve price would increase the resultant tariffs and as such the consumer will have to bear the burden which is against efficiency, however these arguments are partially unacceptable, spectrum prices would be accounted as sunk costs and so will not enter in profit maximising price calculations. The only threat will be when reserve prices are unsustainably high such that the sunk costs are greater than the long run profit or there is liquidity crunch in financing the sunk costs. The optimal reserve
price is very difficult to calculate and hence nothing conclusive can be said about the optimality of the present reserve prices but in the present case it is easy to conclude that the recommendation of high reserve prices by TRAI is revenue-driven, entry deterring and thus will create distortion in market structure.

- In the Indian telecommunication sector, the joint pressure and threat created by the operators for lowering the reserve prices (even to the level of 2001 as advocated by some) or else face higher tariffs gives a signal of some sort of cartel for spectrum price reduction and tariff-hike.

- Secondary trading has been restricted to present holders and only for the purpose of frequency configuration in the recommendation which is not efficient when the spectrum is allocated by the market mechanism of auctions.
COMPETITION AUTHORITY AND SPECTRUM AUCTIONS

The ICN Working Group Report on Telecommunications Services found that both rapid technological change and market liberalization are allowing competition to play a more important role in the telecommunications sector. The relevance of competition policy in the telecom sector is more important to developing countries like India. Consequently, competition authorities are involved as both enforcers of competition law and advocates for the removal of impediments to the development of fully competitive markets. This includes the opportunity to apply competition legislation, enforcement, and remedies to anti-competitive behaviour, as well as to advocate for legislative and regulatory reform.

This Report identifies specific areas where competition policy and CCI has a role in the analysis of auction designs for spectrum allocation in the telecommunications sector. As the competition authority CCI has several enforcement as well as advocacy roles.

In their enforcement role, competition authorities should:

- protect competition in the telecommunications sector by taking appropriate enforcement action against anticompetitive conduct;
- when reviewing potentially anticompetitive activity and deciding whether enforcement action is appropriate, apply sound antitrust analysis (including relevant market definition, market power/dominance) and remedies;
- take into account technological changes that are occurring in the telecommunications industry and that may impact competitive analysis;
- build effective working relationships with the regulatory agencies (if they exist in the jurisdiction) and coordinate their efforts in the review of particular matters, including with respect to emerging services based on new technology and innovation.

In their advocacy role before sector-specific regulators, legislators and the judiciary, competition authorities should encourage:

(a) an effective and transparent system of regulation by advocating for:
- expeditious decision making where appropriate;
- removal of unjustified regulatory restrictions on competition in the provision of communications networks and services and in the usage of spectrum. With respect to entry, competition agencies should advocate that the regulatory framework set by jurisdictions for the provision of such networks and services is consistent with non-discrimination principles. Furthermore, competition agencies should advocate, as a minimum, against the mandating of a single provider for any particular communications service;
- regulation only in such a way as to create or maintain appropriate market incentives;
• forbearance from unnecessary regulation as soon as practicable, taking into account
the availability of existing competition to protect the interests of consumers, and the
ability of existing competition laws effectively to remedy anticompetitive behaviour;
• sound competition analysis in defining markets and assessing the state of
competition in a market;
• the periodic review of regulation to ensure that regulation continues to be
appropriate and is not adversely affecting competition;
• technologically neutral regulation that does not favour one technology over another,
create entry barriers for new technologies, or deter convergence of telecommunications
services;
• when there is a need for social regulation, such as universal service, implementing it
in a competition-neutral manner.

(b) increased competition on the supply side of the telecommunications industry by
advocating for regulations that:

• limit the number of competitors authorized to provide services only where there are
clear constraints on scarce resources and, in any case, based on sound public policy
criteria;
• provide competitors, to the extent necessary, with access to essential or bottleneck
networks owned or operated by incumbent firms by mandating interconnection and
network interoperability and, where appropriate, mandating unbundling, taking into
account the likely long-term effect on investment and innovation.
• set access charges in such a way as to minimize anticompetitive results;
• minimize regulatory uncertainty by ensuring that rules applicable to the offering of
telecommunications services are transparent, including those pertaining to the use
of rights of way and application procedures for installing transmission equipment;
• take into account competitive concerns in determining spectrum availability and its
allocation.

(c) increased competition on the demand side of the telecommunications industry through
reducing switching costs for consumers, by advocacy with respect to such measures as
number portability and carrier pre-selection, while establishing relative charges that are not
anticompetitive.

**Competition authority vs. Regulatory authority**

Often there lies some confusion about the thin line demarcating the powers and functions
of a Regulatory authority from that of the Competition authority.

Regulatory agencies do not act in a purely executive capacity; instead, they **combine
legislative, executive and judicial functions**. They interpret, define and supervise rules, and
introduce sanctions if necessary (Baldwin and Cave 1999: 70). They have a proactive
approach based on *ex ante* regulation. Key arguments for introducing regulatory agencies
are that they are, at least theoretically, independent from both political and private
interests and they show continuity in making decisions that are not bound by party politics
and elections. Additionally, regulatory agencies can build up the expertise needed to make
decisions about complex and technical matters; and their decisions are based on a great
deal of knowledge. However, regulatory agencies are criticised for their lack of
accountability, the threat that political intervention will replace formal independence, the fragmentation of functions between competition law and sector-specific regulation, and for having decision-making processes which are often slow and bureaucratic.

In principle, the main responsibility of the competition authority is to react to anticompetitive market-place behaviour, mostly *ex post*, rectifying problems once they become evident with assistance from regulatory safeguards, such as the asymmetric regulation, to prevent the dominant carrier from taking advantage of its dominant position.

As the telecommunications market shifts from monopoly to competition, there has been increasing involvement of the competition authority in the telecommunications sector. In general, the telecommunication regulator is responsible for technical regulation as well as *telecommunication specific economic and social regulation*. On the other hand, in most countries the competition authority is responsible for *anticompetitive behaviour and mergers*.

In the context of merger reviews between telecommunication companies, the majority of countries give this responsibility to the competition authority. But some countries give exclusive authority to the Ministry or the independent regulator to control mergers in the telecommunications sector on the basis that a merger changes a licensee’s legal status. In countries like the US, Japan, Germany and Canada, both the telecommunication regulator and the competition authority exercise the regulatory power over mergers.

India has a telecommunications regulator and an economy-wide competition authority. Enacted in 2003, India’s Competition Act is in its initial stages of development, with enforcement entrusted to the Competition Commission of India. The Competition Act, 2002, generally prohibits anticompetitive agreements (*i.e.*, one that is likely to cause an appreciable adverse effect on competition within India) and abuse of dominant position (*i.e.*, where an enterprise directly or indirectly, imposes unfair or discriminatory conditions in the purchase and pricing conditions), and regulates corporate “combinations” through the acquisition of shares, control and mergers. The Competition Commission has an express mandate over competition issues with respect to a variety of services, including “communication”.

The Telecommunications Regulatory Authority of India (TRAI) is an autonomous body responsible for the regulation of telecommunications services in India. TRAI is responsible for “facilitate[ing] competition and enforce[ing] efficiency in the operation of telecommunications services” in order to facilitate growth. TRAI is also responsible for adjudicating disputes among service providers and between groups of licensees on matters concerning technical compatibility and interconnection between service providers, revenue sharing arrangements, quality of telecommunications services and interests of consumers. However, the TRAI Act specifically excludes from TRAI’s jurisdiction matters concerning “the monopolistic trade practice, restrictive trade practice and unfair trade practice.” If a matter is brought before TRAI that raises such competition issues, or any other issue under the jurisdiction of the Competition Act, TRAI is required to refer such issues to the Competition Authority.
Role of Competition Authority in auctioning of spectrum and the competition issues involved therein

Perhaps the most interesting part of this report is to find out the role of competition authority in the designing of spectrum allocations and acting as a watchdog over the conduct of the industry.

Having learnt the various competition issues like collusion, entry problems, predatory behaviour and mergers and acquisitions associated with auction designs, it is of prime importance to the CCI to take up its advocacy role in this matter. We have already discussed the difference in roles between a Regulatory and a Competition Authority. Given the recommendations of TRAI for the 2G spectrum auctions, in interests of safeguarding and promoting competition in the sector CCI should review the competitive aspects of the auction and play its advocacy role (to prevent another yet another shameful scam!) wherever it finds activities or clauses contrary to the competition arguments in the theory.

As mentioned in the Competition Act, 2002, The Competition Commission of India is empowered with certain powers, functions and roles, to promote and sustain competition, eliminate practices having adverse effects on competition and protect the interests of the consumers.

With reference to Spectrum allocation by the government to the companies in the telecom sector, CCI has an important advocacy role pertaining to the competition outcomes of the auction designs- the underlying issues of collusion and bid-rigging, entry deterrence, mergers and acquisitions prior to auctions, etc.

Focussing on the features of the Competition Act, 2002, and its relevance to spectrum auctions is our primary concern:

Prohibition of Anti-Competitive Agreements

Section 3 of the competition Act specifies agreements\(^1\) deemed to be inimical to competition and deemed illegal. It says “No enterprise or association of enterprises or person or association of persons shall enter into any agreement in respect of production, supply, distribution, storage, acquisition or control of goods or provision of services, which causes or is likely to cause an appreciable adverse effect on competition within India”. The section relevant to this report is discussed below.

- Section 3(3(d)) prohibits any agreement or association which “directly or indirectly results in bid rigging or collusive bidding, shall be presumed to have an appreciable adverse effect on competition”- in this context we have already gained insights of various auction designs and their relative vulnerability to signalling strategies and tacit collusion. Having known this, it is in best interests of competition that CCI is
referred to analyse the design with respect to these issues and their impacts before finalisation of the design and allotment.

**Prohibition of Abuse of Dominant Position**

Dominance refers to a position of strength which enables an enterprise to operate independently of competitive forces or to affect its competitors or consumers or market in its favour. Abuse of dominant position impedes fair competition between firms, exploits consumers and makes it difficult for other players to compete with the dominant undertaking on merit. The Competition Act does not prohibit dominance it prohibits abuse of such dominance (section 4). The Competition Act roughly considers the following as abuse of dominant position:

- Unfair pricing or discriminatory pricing (including predatory pricing)
- Limiting production or technical development
- Denial of market access
- Creating barriers to entry
- Using dominant position in one market to gain advantage in another market.

In Indian telecommunication market it is difficult to figure out any single dominant private operator in fixed line as well as any single dominant operator in the wireless communication. The market for mobile phone communication in India features multiple big players like Bharti Airtel, Vodafone India, Reliance Communication, Idea Cellular etc. We have learnt from the study of auction designs and auction examples that the abuse of dominance (if any) in case of spectrum auctions can take place in the form of threat of predatory pricing behaviour which would deter entrants from participating in the auction, refusal to interconnections in future in case the entrant manages to enter, denial to share infrastructure and provide roaming on the incumbent’s network which makes it uneconomical on part of new firms to enter. To deal with the entry problem is extremely important for the success of an auction in ensuring competitive allocation and the role of CCI should be to invigilate that such grounds for healthy competition are provided to the players by checking any such abuse of dominance.

**Regulation of Combination**

Combination includes acquisition of control, shares, voting rights or assets, acquisition of control by a person over an enterprise where such person has control over another enterprise engaged in competing businesses, and mergers and amalgamations between or amongst enterprises where these exceed the thresholds specified in the Act in terms of assets or turnover. If a combination causes or is likely to cause an appreciable adverse effect on competition within the relevant market in India, it is prohibited as per regulation of combinations (section 6) and can be scrutinised by the CCI.

- With reference to the spectrum auctions, the mergers and acquisitions accomplished specifically in relation to the acquiring of spectrum cannot be ruled out. Loopholes in the auction rules and regulations may provide ample scope for pre-auction merger and acquisitions for the purpose of emerging as a joint dominant bidder in the auction. This may adversely affect competition when such
acquisition significantly restricts the other firms’ possibility to acquire licenses or spectrum and also creates a threat to entrants. Thus, section 6(1) which says “No person or enterprise shall enter into a combination which causes or is likely to cause an appreciable adverse effect on competition within the relevant market in India and such a combination shall be void” is applicable in such circumstances.

• TRAI in its recent recommendations (and in response to the DoT views of the recommendations) on Spectrum management and Licensing framework (Oct-Nov 2011) mentioned the following important points regarding consolidation of spectrum:
  - The Authority noted that fragmentation of spectrum, a valuable but finite resource, was not desirable in the Telecom industry where size is increasingly becoming an advantage in the delivery of telecommunication services to the people. It therefore felt that consolidation of spectrum was something to be facilitated.
  - For determination of market power, market share of both subscriber base and Adjusted Gross Revenue of licensee in the relevant market shall be considered
  - At the end of June 2011, the seven major players enjoy a significant market share of 93.82% while the six new players cumulatively have a share of only 6.18%. The Authority therefore feels that there is scope to liberalise the measures towards consolidation of spectrum
  - Where the market share of the Resultant (merged) entity in the relevant market is not above 35% of the total subscriber base or the AGR in a licensed service area, the Government may grant permission at its level. However, where, in either of these criteria, it exceeds 35% but is below 60%, Government may decide the case after receipt of recommendations from the TRAI. Cases where the market share is above 60% shall not be considered.
  - Consequent upon the merger of licences in a service area, the total spectrum held by the Resultant entity shall not exceed 25% of the spectrum assigned, by way of auction or otherwise, in the concerned service area in case of 900 and 1800 MHz bands. In respect of 800 MHz band, the ceiling will be 10 MHz. In respect of spectrum in other bands, relevant conditions pertaining to auction of that spectrum shall apply.

• After going through the above recommendations it is very obvious that the role of competition authority in determining the viability of such mergers in competition terms have been ignored. Spectrum is undoubtedly a scarce resource and its consolidation may be justified on these grounds but due considerations must be given to the concentration of economic power as a result of such combinations.

• Therefore as mergers and acquisitions are becoming so important in the spectrum auctions so should be the regulations of any such combination, having appreciable adverse effect on competition, by the CCI.
Advocacy Role

Section 49 of the Competition Act enshrines the advocacy role of the Competition Commission of India. One of the objectives of this report is to highlight the competition advocacy role of the CCI with respect to the spectrum auctions (and auction designing) in the telecommunication sector of India.

CCI needs to actively participate and make its presence felt to remove any possible threats to competition due to shortcomings of the auction mechanism (procedure) through its advocacy role.

- Section 49 (1) states “The Central Government may, in formulating a policy on competition (including review of laws related to competition) or any other matter, and a State Government may, in formulating a policy on competition or on any other matter, as the case may be, make a reference to the Commission for its opinion on possible effect of such policy on competition and on the receipt of such a reference, the Commission shall, within sixty days of making such reference, give its opinion to the Central Government, or the State Government, as the case may be, which may thereafter take further action as it deems fit.”

-thus CCI is eligible to be consulted before deciding on merger policies related to spectrum.

- Section 49 (3) states “The Commission shall take suitable measures for the promotion of competition advocacy, creating awareness and imparting training about competition issues.”

–hence in the best interests of competition CCI has an role in advising the authorities regarding auction designs, warning them against possible threats to competition (collusion, bid rigging, entry deterrence, predation and combinations) associated with the specific procedure. It also needs to create awareness regarding different competition and related issues involved in auctioning of spectrum (clear doubts concerning reserve prices, secondary trading and e-auctions).

Thus, the Competition Commission of India has diverse roles to play in the auctioning of scarce spectrum in order to safeguard and promote competition in the telecommunication sector.
SUGGESTIONS AND CONCLUSION

The study of various auction designs and its implication on competition in this report reaffirms the view that industrial-organization issues are more important than the informational issues on which the auction literature has mostly focused. In particular, the problems of attracting entrants and dealing with alliances and mergers are likely to remain major preoccupations of telecom-auction designers for the foreseeable future. Tackling such problems sensibly requires high-quality market research that keeps pace with developments in an industry that can change its clothes with bewildering rapidity. We also need more theoretical work on the industrial-organization implications of major auctions to make a further extensive.

The use of auctions to enhance allocative efficiency of a scarce resource such as telecom spectrum is undisputable. However, the desired efficiencies shall not be realized unless the auction design and spectrum management policies are both optimal. The primary goals of a well-designed auction which is the life-blood of competitive culture should be price discovery and to induce truthful bidding. Efficient assignment is only possible when these pre-requisites of competitive price-determination are satisfied. Transparency is an added benefit which auctions provide and which induces greater public-confidence in allocation procedure of what is public property.

The above were the goals of auction design, however the goals of any auction procedure is decided by the authority conducting the same. In the Indian case the objectives in the 3G auction in order of priority were (a) efficiency, (b) stimulating competition and (c) revenue generation. Having analysed the 3G auctions in India and the recommendations for the 2G spectrum auction, we can conclude that there are many commendable features in the design opted, but also that there is considerable room for improvement in the design of the auction rules if the stated policy ends of allocative efficiency, post-auction market competitiveness and maximization of auction revenue are to be met.

A few suggestions for the upcoming auctions:

- Efficiency and competition enhancement should be given greater priority, given downstream competition is efficient and auction design induces truthful bidding, efficiency will raise revenue as by-product.
• Thus, setting optimal reserve price to maximize revenue should always be subject to efficiency and competition constraints, such that problems like entry deterrence and concentration of power can be addressed.

• The auction design should encourage entry and hence incentives to entrants in form of not so high reserve prices, setting aside spectrum for entrants, provision of network sharing and roaming should be provided.

• The current activity rule can be improved upon by replacing quantity based rule with revealed preference based rule.

• Role of secondary spectrum trading should be recognised.

Apart from the design and objectives, there are certain policy and institutional issues which command due importance. The Telecom Regulatory Authority of India, and Department of Telecommunication, should work in conjunction with the Competition Commission of India to reconcile the policies in conflict with competition, for example merger policies for consolidation of spectrum, decision of with-holding spectrum and its impact on market structure, trading of spectrum in secondary market and efficiency therein and the conflicting goals of maximising revenue vs. efficiency.

Although this report focussed specifically on the spectrum auctions in the telecommunication sector of India, the implications and conclusions derived can be generalised to other such sectors like coal, water, land where allocation of scarce resources still undergoes the torments of administrative procedures. It is to be recognised that auctions as an allocation procedure is the most efficient mechanisms among all and a well-designed auction is the work horse of efficiency and competition. However, in the Indian case these facts are yet to gain recognition. The Chawla Committee report, which continues to gather dust in the corridors of power, had recommended following a competitive bidding route for allocation of coal blocks, switching to open acreage licensing policy for allocation of oil and gas blocks, making public the minutes of the meeting of the Standing Linkage Committee (Long Term) pertaining to allocation decisions, but any substantial transformation is yet to see its dawn.

Last but not the least in importance, the study in this report emphasises on CCI’s role as a watchdog against anti-competitive activities and collusive strategies (activities in violation of the competition law) associated with auction design for spectrum. Further, it recognizes that CCI has an advocacy role in advising the respective authorities and creating awareness about the impact of auction design on competition.
APPENDIX

EMPIRICAL OBSERVATIONS AND ECONOMETRIC ANALYSIS

Madden et al (Working Paper, Feb 2010) made a study that empirically examines a sample of national wireless spectrum assignments for the period 2000-2007 to identify the sources of revenue variations. The first 3G spectrum license auctions are held in Western Europe in 2000. Their study examines a sample of 81 licenses from 21 national auctions for 2000–2007. These data was sourced from the DotEcon (2008) Spectrum Awards Database. With the help of an econometric model, the authors made exploration of the impact of auction designs, rules and award processes on the realized revenues. The particular auction attributes analysed (license award processes) are: number of bidders per license; availability of an activity rule; publicity of bid information; flexibility of the number of licenses; availability of package bidding; reserve price; duration of auction and the bid format (sealed or open). Study findings show that most of these license award/auction design variables independently impact on 3G spectrum auction revenues in a manner consistent with auction theory.

They identified factors affecting the Mobile Network Operator (MNO)’s valuation for spectrum.

An MNO (Operator $j$) assesses an opportunity to acquire spectrum based on whether

$r_{ij} - b_{ij} > 0,$

where $r_{ij}$ is the projected net revenue from use of spectrum package $i$ (based on spectrum award conditions, and operating revenue and cost estimates) through the license period, and $b_{ij}$ is the final spectrum bid price made by the operator for the spectrum resource. Further, the quantity $b_{ij} - b_{ij}^{\text{min}} > 0$ is the bid premium an operator offers to obtain the spectrum license, i.e., the excess above the reserve bid price ($b_{ij}^{\text{min}}$) required by the in the tender document. The award value must not only exceed the minimum required spectrum bid price (reserve price) but be the largest value among all bidders. The spectrum assignment is efficient when the bid price accurately reflects the underlying opportunity costs of the firm. When $r_{ij} - b_{ij}^{\text{min}} < 0$ then no bid is made as the operator incurs losses in providing 3G service over the spectrum. From the published spectrum awards, data observable to the analyst is the winner’s bid price, $b_{ij}^{*}$. When there is no bid (and hence no winner) $b_{ij}^{*}$ is censored at a zero value. Factors that potentially impact on the winning spectrum bid price that are identified by the literature include spectrum package attributes. Attributes considered in their analysis are: license duration (Klemperer, 2002a), whether an entrant must be awarded a license (Klemperer, 2002a), and the magnitude of the required minimum bid (reserve) price (Burguet and Sakovics, 1996; Klemperer, 2002a). Variables that describe the license award process include the competitiveness of the process (Klemperer, 2002b) and auction design variables,
viz., whether: (a) there are activity rules; (b) information is made available at the end of each round; (c) there is a single sealed-bid; (d) license number is determined endogenously; and (e) if package bidding is allowed.

The dependent variable WBID was censored with only winning bid values greater than the reserve bid price observed. That is, the observed price must not only be the largest value among all bidders, but must also exceed the NRA-specified minimum spectrum bid price. When the maximum bid (based on operator valuation) did not exceed the minimum spectrum bid price then the associated ‘observed’ price is zero. The regression model based on the preceding discussion is referred to as the censored regression model. The regression is obtained by making the mean of the censored model correspond to a classical regression model. The general formulation is:

$$y_{ij}^* = x'\beta_j + e_{ij}$$

$$y_{ij} = 0, \text{ if } y_{ij}^* \leq 0,$$
$$y_{ij} = y_{ij}^*, \text{ if } y_{ij}^* > 0,$$

where $$x_i = (1, x_{i1}, \ldots, x_{ip})'$$ is a vector of $$p$$ covariates which affect Spectrum Package I valuations and $$\beta_j = (\beta_{j0}, \beta_{j1}, \ldots, \beta_{jp})'$$ is a corresponding vector of parameters to be estimated.

The stochastic component, $$e_{ij}$$ consists of unobserved factors that explain the marginal spectrum valuations of Operator $$j$$. Each $$e_{ij}$$ is drawn from a $$J$$-variate Normal distribution with zero conditional mean and variance, where $$e \sim N(0, \Sigma)$$.

The regression model variables were as follows:

<p>| Table 1. Dependent Variable Summary Statistics, 2000–2007 |
|---------------------------------|----------|-----|</p>
<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBID</td>
<td>Spectrum payment/MHz/million population (US$m)</td>
<td>0.88</td>
<td>1.33</td>
</tr>
<tr>
<td>Variable</td>
<td>Definition</td>
<td>Mean</td>
<td>Std Dev.</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------------------------------------------</td>
<td>--------</td>
<td>----------</td>
</tr>
<tr>
<td><strong>National economic and mobile market</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INCOME</td>
<td>Real GDP per capita (US$ PPP)</td>
<td>21.607</td>
<td>9.564</td>
</tr>
<tr>
<td>MARKET</td>
<td>Size of population covered by license (millions)</td>
<td>346.18</td>
<td>504.19</td>
</tr>
<tr>
<td>MCOMP</td>
<td>Inverse of one plus the number of facilities-based operators</td>
<td>0.22</td>
<td>0.04</td>
</tr>
<tr>
<td>SHIFT</td>
<td>= 1, if auction is held in 2001–2007; = 0, otherwise</td>
<td>0.62</td>
<td>0.49</td>
</tr>
<tr>
<td><strong>Spectrum package attributes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DURATION</td>
<td>License term (years)</td>
<td>17.95</td>
<td>2.86</td>
</tr>
<tr>
<td>ENTRANT</td>
<td>= 1, if at least one license must be awarded to entrant; = 0, otherwise</td>
<td>0.12</td>
<td>0.33</td>
</tr>
<tr>
<td>RESERVE</td>
<td>Minimum allowable spectrum bid price (US$ millions)</td>
<td>184.81</td>
<td>444.16</td>
</tr>
<tr>
<td><strong>Post-award financial obligations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PERCENT</td>
<td>Mean annual license fee (% of 3G revenue)</td>
<td>0.22</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>Post-award network deployment obligations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEPLOY</td>
<td>% of population to be covered by license/years to achieve cover</td>
<td>0.12</td>
<td>0.08</td>
</tr>
<tr>
<td>SHARE</td>
<td>= 1, if infrastructure sharing is imposed; = 0, otherwise</td>
<td>0.33</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>License award process</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACOMP</td>
<td>Bidders to available licenses (ratio)</td>
<td>1.21</td>
<td>0.59</td>
</tr>
<tr>
<td>ACTIVITY</td>
<td>= 1, if there is an activity rule; = 0, otherwise</td>
<td>0.62</td>
<td>0.49</td>
</tr>
<tr>
<td>INFO</td>
<td>= 1, if bid information made public every round; = 0, otherwise</td>
<td>0.38</td>
<td>0.49</td>
</tr>
<tr>
<td>NUMBER</td>
<td>= 1, if license number is exogenous; = 0, otherwise</td>
<td>0.74</td>
<td>0.44</td>
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<tr>
<td>PACKAGE</td>
<td>= 1, if package bidding is allowed; = 0, otherwise</td>
<td>0.27</td>
<td>0.45</td>
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<tr>
<td>SEALED</td>
<td>= 1, if the auction is sealed-bid; = 0, otherwise</td>
<td>0.20</td>
<td>0.40</td>
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Table 7. Censored Regression Estimates

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td>-3.602***</td>
<td>(0.917)</td>
</tr>
<tr>
<td>National economic and mobile market conditions</td>
<td>INCOME</td>
<td>0.000*</td>
<td>0.000*</td>
</tr>
<tr>
<td></td>
<td>MARKET</td>
<td>0.000***</td>
<td>0.000***</td>
</tr>
<tr>
<td></td>
<td>MCOMP</td>
<td>1.662</td>
<td>1.645</td>
</tr>
<tr>
<td></td>
<td>SHIFT</td>
<td>-2.433***</td>
<td>-2.406***</td>
</tr>
<tr>
<td>Spectrum package attributes</td>
<td>DURATION</td>
<td>0.236***</td>
<td>0.234***</td>
</tr>
<tr>
<td></td>
<td>ENTRANT</td>
<td>0.138</td>
<td>0.136</td>
</tr>
<tr>
<td></td>
<td>RESERVE</td>
<td>0.000*</td>
<td>0.000*</td>
</tr>
<tr>
<td>Financial obligations</td>
<td>PERCENT</td>
<td>-0.077</td>
<td>-0.076</td>
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<tr>
<td>Network obligations</td>
<td>DEPLOY</td>
<td>0.737</td>
<td>0.730</td>
</tr>
<tr>
<td></td>
<td>SHARE</td>
<td>0.033</td>
<td>0.033</td>
</tr>
<tr>
<td>License award process</td>
<td>ACOMP</td>
<td>0.737***</td>
<td>0.730***</td>
</tr>
<tr>
<td></td>
<td>ACTIVITY</td>
<td>-0.412**</td>
<td>-0.415**</td>
</tr>
<tr>
<td></td>
<td>INFO</td>
<td>0.530***</td>
<td>0.525***</td>
</tr>
<tr>
<td></td>
<td>NUMBER</td>
<td>-2.168***</td>
<td>-2.145***</td>
</tr>
<tr>
<td></td>
<td>PACKAGE</td>
<td>0.205</td>
<td>0.203</td>
</tr>
<tr>
<td></td>
<td>SEALED</td>
<td>-0.039</td>
<td>-0.038</td>
</tr>
<tr>
<td>N</td>
<td>ANOVA</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DECOMP</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Log likelihood</td>
<td>-38.15</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.
Turning to the impact of the explanatory variables on the 3G winning bid value (WBID), for variables describing spectrum package attributes, both length of license and reserve price matter (DURATION = 0.234 and RESERVE = 0.000). Importantly, license duration is specified by NRAs in tender documents. Thus, the positive sign for DURATION is consistent with the predicted positive association between the winning license bid and license value to the winning bidder. The reported positive sign of RESERVE is consistent with the view of Klemperer (2002a) and Cramton (2004) that sufficiently high reserve prices discourage Collusion.

The effect of SEALED on WBID is unclear. Auction theory suggests that more entrants and higher returns are expected under sealed-bid auctions than non-sealed (mostly ascending) simultaneous auctions (proposed by Paul Milgrom, Robert Wilson and Preston McAfee), since collusion is harder in sealed-bid auctions as bids cannot be used as signals (Klemperer 2002a).

The spectrum package variable ENTRANT is not significant (10%) which contrasts with the claim that by awarding at least a single license to a non-incumbent firm the auctioneer expects to attract more (new) bidders and so receive higher winning bids. The spectrum package variable ENTRANT is not significant (10%) which contrasts with the claim that by awarding at least a single license to a non-incumbent firm the auctioneer expects to attract more (new) bidders and so receive higher winning bids.
BIBLIOGRAPHY


8) TRAI Consultation Paper on Auction of Spectrum, 7th March, 2012 www.trai.gov.in

9) TRAI Recommendation on Auction of Spectrum, 23rd April 2012, www.trai.gov.in

10) Supreme Court Verdict on 2G scam, 2nd February, 2012

11) DotEcon and Rothschild presentation on Indian 3G auction design, www.dotecon.com

12) John W. Mayo, Scott Wallsten, Enabling efficient wireless communications: The role of secondary spectrum markets, IEP, 2009


14) Collecting Revenue for Spectrum, A report for GSMA, February 2012, DotEcon

15) International Telecommunication Union- Workshop of Competition Policy in Telecommunication sector, 2002

16) Petros A. Vallindas, Telecom Regulation: Institutional Structures, Responsibilities and the European Experience
17) ICN Working Group on Telecommunication Services- Role of Competition in the Telecommunication Services Sector

18) H.D Butcher, Telecom Regulation-Competition, UNESCAP, February 2010


20) The Hindu, Newspaper

21) Economic Times, Newspaper

22) Business Standard, Newspaper