Auctioning Encumbered Spectrum

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Auctioning Encumbered Spectrum

• Prior spectrum allocations no longer efficient
  – Microwave users in PCS band
  – UHF TV broadcasters in 700 MHz band
• FCC must reallocate encumbered spectrum for new use
• How to achieve efficient clearing of incumbents?
Alternative Approaches to Clearing

• Post-auction negotiation
• Parallel auction (clearing simultaneous with FCC auction)
• Two-sided auction (clearing integrated with FCC auction)
• Clearing pre-auction (before FCC auction)
Post-Auction Negotiation

• How to structure negotiations between entrants and incumbents?
  – Doesn’t matter if no bargaining costs
  – But bargaining costs may be substantial

• Alternative relocation rules
  – Right to stay
  – Right to move without compensation
  – Right to move with compensation
  – Delayed right to move
Efficiency

- $c =$ cost of relocating incumbent (public)
- $v_i =$ value to incumbent of current use
- $v_e =$ value to entrant of clear spectrum
- Take action with least cost or smallest value loss
  - Relocate if $c < v_i$ and $c < v_e$
  - Clear if $v_i < c$ and $v_i < v_e$
  - Accommodate if $v_e < c$ and $v_e < v_i$
### Outcome Under Each Rule without Negotiation

<table>
<thead>
<tr>
<th>Case</th>
<th>Efficient outcome</th>
<th>Right to stay</th>
<th>Right to move without compensation</th>
<th>Right to move with compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $c &lt; v_i &lt; v_e$</td>
<td>Relocate</td>
<td>Accommodate</td>
<td>Relocate</td>
<td>Relocate</td>
</tr>
<tr>
<td>2. $c &lt; v_e &lt; v_i$</td>
<td>Relocate</td>
<td>Accommodate</td>
<td>Relocate</td>
<td>Relocate</td>
</tr>
<tr>
<td>3. $v_i &lt; c &lt; v_e$</td>
<td>Clear</td>
<td>Accommodate</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td>4. $v_i &lt; v_e &lt; c$</td>
<td>Clear</td>
<td>Accommodate</td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>5. $v_e &lt; c &lt; v_i$</td>
<td>Accommodate</td>
<td>Accommodate</td>
<td>Relocate</td>
<td>Accommodate</td>
</tr>
<tr>
<td>6. $v_e &lt; v_i &lt; c$</td>
<td>Accommodate</td>
<td>Accommodate</td>
<td>Clear</td>
<td>Accommodate</td>
</tr>
</tbody>
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Pr(Efficient) | 1 | 1/3 | 2/3 | 5/6 |
Negotiation Difficulties

• Values are privately known; cost is public
• Holdout problem
  – Many incumbents may need to be cleared in particular market
• Free-rider problem
  – Clearing an incumbent may benefit multiple entrants
Relocation Policy

- Best policy depends on priors about desirability of relocating, clearing, or accommodating
- Right to stay requires difficult negotiation most often
- Right to move with compensation greatly reduces holdout problem, yet makes incumbent whole
- Relocation rule is important even if do not rely on post-auction negotiation
Parallel Auction

• FCC auctions encumbered spectrum
• Private auction for options to clear incumbents run at same time
  – Incumbent states clearing cost by year
  – Incumbent sells option to clear according to these terms
• Difficulties
  – Requires participation by incumbents
  – New licenses and old licenses are strong complements
    • Should be bundled together, but how to price separate parts?
Two-Sided Auction

• Same as parallel auction, but now FCC conducts a single integrated auction, allowing improved coordination
• Incumbents offer their licenses with reserve prices
• Bundling is likely desirable, due to strong complements, but how to price parts?
• Combinatorial bidding may be desirable if bidders differ in extent/form of complementarities; otherwise, bundle
• Allows incumbent to either buy or sell depending on prices
Clearing Pre-Auction

- Resolve clearing issue before FCC auction
- Identify the least-cost clearing solution
- Appropriate when multiple license holders can compete to be the one to clear
- Reduces uncertainty and delay
- Improves auction efficiency; bidders compete equally for clear spectrum
700 MHz Auction

- FCC to auction 30 MHz in 700 MHz band on September 6
- 700 MHz spectrum offers potential for wireless competition in broadband market
- Spectrum is encumbered by existing UHF broadcasters, blocking use by new licensees in most major markets
- Spectrum is worth much more if clear of incumbent broadcasters
700 MHz Band Plan

Commercial / PS Band Channels

UHF TV Channels

<table>
<thead>
<tr>
<th>59</th>
<th>60</th>
<th>61</th>
<th>62</th>
<th>63</th>
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<th>66</th>
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<td>752</td>
<td>758</td>
<td>764</td>
<td>770</td>
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<td>782</td>
<td>788</td>
<td>794</td>
<td>800</td>
<td>806</td>
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</tbody>
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Incumbent broadcasters have co-channel and adjacent-channel protection

Commercial / PS Band Channels

UHF TV Channels

License C winner must clear 59-61 and 64-66
Incumbent broadcasters have co-channel and adjacent-channel protection

Commercial / PS Band Channels

UHF TV Channels

License D winner must clear 60-63 and 65-68
Incumbent broadcasters have co-channel and adjacent-channel protection

Commercial / PS Band Channels

UHF TV Channels

Public Safety must have 62-65 and 67-69 cleared
Is interference a problem?
UHF Ch 59-69 in Greater NY
Spectrum Exchange Plan

• New broadband services in 700 MHz band require that broadcast operations in the band be cleared much sooner than the end of the transition to DTV

• Spectrum Exchange will conduct a private auction for the purpose of clearing the encumbered spectrum

• The Spectrum Exchange Auction will enable bidders in the FCC’s 700 MHz Auction to bid with confidence that the spectrum will be cleared at an early date — and at a known cost
Importance of Early Clearing Agreements

• Without agreements,
  – Holdout will delay or prevent efficient spectrum use, destroying public value
  – Winning bidders may be those best able to deal with incumbents, rather than those best qualified to use the spectrum

• Introducing one or more “comparable” stations and holding a clearing auction dramatically improves the situation
  – The competition shifts the bargaining away from the value of the cleared spectrum and toward the cost of clearing
  – Those stations that can clear at lowest cost will do so, thus minimizing any loss of broadcast service
Example of Relocation: Chicago

- Four stations, collectively encumbering 100% of the commercial band, need to clear
  - WEHS 60 (Aurora, IL): broadcasts off Sears Tower
  - WJYS 62 (Hammond, IN): broadcasts 24 miles from Chicago (and its DT counterpart is licensed to broadcast off Sears Tower)
  - WGBO 66 (Joliet, IL): broadcasts off Hancock Tower
  - WEHS-DT 59 (Aurora, IL): licensed to broadcast off Sears Tower

- However, there is a total of 9 comparable analog stations (the 3 above, plus 6 other analog UHF stations) that could clear
Chicago: UHF 60, 62, 66, 59DT
The Mechanics of the Clearing Auction

• Spectrum Exchange enters into contracts with applicants in the FCC Auction and with incumbent broadcasters
  – FCC applicants agree to pay for the clearing at a price determined by the private auction
  – Broadcasters agree to make their bids in the private auction contractually binding
    • Incumbent broadcasters (Channels 59–69) receive incentive payments in return for their commitment to clear or relocate
    • If an incumbent broadcaster (Channels 59–69) wins the private auction, then it receives both the incentive payment and the amount determined by the private auction
The Mechanics of the Clearing Auction (cont.)

• The auction identifies stations that can clear at lowest cost

• The auction proceeds as a “descending clock”: the auction begins with the auctioneer naming a high price and allowing it to descend toward zero

• Stations periodically indicate whether they are “in” at the current price (i.e., willing to clear at that price) or “out”

• The auction concludes when only as many stations as are needed to clear remain in the auction
How the FCC Can Facilitate Clearing

• Allow early transition to DTV-only

• Assure transitioning broadcasters of continuing cable carriage

• Establish relocation rule for channel 59–69 broadcasters