Spectrum Pricing and Economics

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Effective spectrum pricing

Spectrum prices should promote, and not undermine, the optimal use of spectrum for the benefit of society
What are we going to discuss today?

- What are the trends in spectrum pricing?
  - Final prices and reserves
- What is the impact of spectrum prices on consumers?
  - What does the economic literature predict?
  - What is happening in practice?
- What is spectrum pricing policy best practice?
  - Common mistakes and best practice
The Context

- **Data growth and tech evolution make more spectrum vital**
  - Mobile traffic increased 9x in past 5 years in Western Europe
  - LTE-A and 5G are much more spectrum hungry

- **Operators concerned that today’s model is unsustainable**
  - Spectrum demand is growing faster than revenues
  - Perception that spectrum prices are rising thus aggravating the issue
  - View that high prices are often due to policy decisions – not the market

- **Some public authorities don’t see downside of high prices**
  - View that ‘sunk costs’ and competition prevent negative consequences
What Will Be Your Key Takeaways?

- Final spectrum prices – and reserve prices – are rising
- Extremely high price outcomes are more common
  - These are typically due to national policy factors
- Evidence shows high prices negatively impact consumers
  - They risk award failure – so spectrum which could benefit society goes unused
  - High prices are linked to lower quality mobile broadband and higher consumer bills
- National spectrum policy normally explains very high prices
  - E.g., High reserve prices, spectrum scarcity, no spectrum roadmap and bad award rules
  - Such policies don’t suit a competitive industry with a long-term investment profile

High price policies threaten the success of digital economies and 4G/5G
Final prices in the 4G era are trending upwards

- Large increase in new awards since 2007 to support 4G and for some licence renewals
- Average prices rose 250% from 2008-2016
  - increase in reserve prices
  - more sub-1GHz awards
  - growth in high price outliers
- Operators spending greater proportion of revenue on spectrum than ever before

Prices per MHz pop are adjusted for inflation and were converted to USD using IMF purchasing power parity (PPP) rates. Prices are also adjusted for licence duration, based on a standard 15 years, using a 5% discount rate.
Reserves in the 4G era are trending upwards

- Average reserves rose 400% from 2008-2016
- Notable very high price outliers
  - Coincides with awareness that the spectrum is vital for 4G services
  - Ratcheting possibly linked to benchmarking against high prices

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How can spectrum prices impact consumers?

High spectrum prices can impact consumers in two ways

1. High reserves can lead to spectrum going unsold
   - Worryingly digital dividend spectrum has gone unsold in several countries
   - Lost consumer & economic benefits from unsold spectrum cannot be regained

2. High final prices could lead to reduced network investment, higher consumer prices and lost consumer welfare benefits
   - Growing amount of academic literature finds that operators may not always treat spectrum as a sunk cost
How can spectrum prices impact consumers?

Economic theory predicts high prices could negatively impact consumers

| 1. Hold-up problem                      | • Spectrum awards are not one-off  
|                                       | • If firms believe their expected returns will be extracted in successive auctions, they will change their investment strategy |
| 2. Internal financing constraints      | • High prices may exhaust scarce, lower-cost internal funds  
|                                       | • Access to investment capital from multinational parents or external sources may be rationed in response to low profitability |
| 3. Observed pricing decisions          | • In sectors with naturally constrained competition, firms with high sunk costs may engage less in price competition  
|                                       | • Expensive licences may act as a signal for firms to set higher prices |
High spectrum prices linked to higher data bills

Notes: Excludes Chile, which is an outlier owing to late adoption of 4G, which depresses its wireless score.
Consumer welfare impact of spectrum prices

- Econometric model estimates the impact on consumer surplus of lower spectrum costs on consumer data bills across 32 countries
  - Supply curve: spectrum cost, GDP per capital, urbanisation, HHI
  - Demand curve: GDP per capita, price per 1GB of data
- Framework is inspired on similar research by Hazlett and Munoz (2004) which addresses mobile voice
- Model is used to calculate the scale of welfare gains that could be realised
- Only considers the welfare impact of lower consumer prices – not the impact of lower network investment or other downstream economic impacts

Demand for Mobile Broadband

- Price
- Price reduction as a result of lower spectrum costs
- Quantity

Consumer surplus gain from lower spectrum costs
Consumer welfare losses from higher spectrum prices

- Welfare gains from reducing spectrum cost in countries where it sold for above the median
- Chart shows lost consumer surplus against lost auction revenues by country
  - These are indicative examples
  - Actual lost welfare may be significantly lower or higher depending on local factors

<table>
<thead>
<tr>
<th></th>
<th>TOTAL on PPP basis</th>
<th>Per capita on PPP basis</th>
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<tbody>
<tr>
<td>Consumer surplus</td>
<td>$445bn</td>
<td>$208</td>
</tr>
<tr>
<td>Auction revenues</td>
<td>($192bn)</td>
<td>($90)</td>
</tr>
<tr>
<td>Unrealised gains in consumer welfare</td>
<td>$253bn</td>
<td>$118</td>
</tr>
</tbody>
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Notes: Excludes Chile, which is an outlier owing to late adoption of 4G, which depresses its wireless score.

Notes: South Korea is located off the top left hand side of the graph; it has an exceptionally high wireless score (29.5) and median cost of spectrum per pop ($53). We excluded Hong Kong and Singapore from our analysis, as they are city states and much easier to cover with 4G.

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Spectrum pricing study highlights increases

Across a sample of
32 COUNTRIES
15 had costs above the median for their peer group

The lost economic gains across these countries amounted to $445bn

The net economic gain from lower spectrum prices would be $253bn or $118 per person

"Governments and regulators must fully appreciate their ability to maximise - or thwart - their digital futures through spectrum pricing"

Brett Tarnutzer
Head of Spectrum, GSMA
Spectrum pricing study highlights increases

- **Average Spectrum Price**
  - 250% increase from 2008 to 2016
  - Some outliers
  - 700% over the average in 2016

- **Average Reserve Prices**
  - 400% increase in the minimum amount operators must pay
What is happening in practice?

Studied 325 spectrum awards across 60 countries and found that:

- **Higher prices were linked to lower quality mobile broadband services**
  - Each country was given a wireless score (based on data speed, coverage and adoption)
  - High spectrum prices were statistically correlated with lower wireless scores

- **Higher prices were linked to more expensive consumer mobile data bills**
  - An index was built based on the average price of 1 GB of data
  - High spectrum prices were statistically correlated with more expensive data bills

*These correlations were strongest in high and medium income markets. They were less strong in low-income markets due to the lack of available data and wide variation between countries but we expect them to follow the same path*
Most common spectrum pricing mistakes

1. Excessive reserve prices or annual fees
   - Cause: pressures to maximise treasury revenues, inappropriate benchmarks etc..
   - Impact: Valuable spectrum goes unsold, barrier to entrants/smaller MNOs, creates a financial burden on operators that discourages investment and price competition

2. Artificial spectrum scarcity or uncertain spectrum roadmap
   - Cause: Deliberate scarcity, regulatory challenges (inc. band planning/clearing) etc.
   - Impact: Spectrum unused, inflates reserves/valuations, discourages investment/competition

3. Award rules that put enterprise value at risk or create incentives to foreclose competition
   - Big multi-band auctions with little transparency can create pressures to overbid
   - Anticompetitive rules can allow large operators to “freeze out” rivals (e.g. Turkey 1800MHz)
Pricing should reflect industry characteristics

- Surveyed pricing approaches in many scarce resource-dependent industries
- Key observations were:
  - Best practice is tailored to industry characteristics
  - Pricing policy in mobile should reflect its position as a competitive industry with medium-high investment risk
Lessons from other industries

**MARKET LED PRICING**

Spectrum is a competitive market input:
- In competitive markets, policymakers use the market to promote efficient allocation and set market prices
- This contrasts with monopoly markets, where licence fees and consumer prices are linked and tightly regulated

**FULL ALLOCATION**

Spectrum is a renewable resource:
- When values cannot be stored, policymakers maximise welfare by allocating all available capacity
- Trade-off between price and time is only relevant when resource depletes

**RISK SHARING**

Mobile network investments carry risk:
- Policymakers can raise the value of licences through risk sharing
- Risk mitigation is particularly relevant when licence obligations are onerous

**LONG-TERM APPROACH**

Welfare maximisation requires a long-term perspective:
- Consumer welfare generation throughout the life of the licence should be the priority
- Decisions on allocation and price should be objective and evidence-based
The road to success in four steps

Set modest reserve prices and annual fees, and rely on the market to set prices

License spectrum as soon as it is needed, and avoid artificial spectrum scarcity

Avoid measures which increase risks for operators

Publish long-term spectrum award plans that prioritise welfare benefits over state revenues.
Make sure to avoid these mistakes

- **EXCESSIVE RESERVE PRICES**
  - Minimum upfront fee too high
  - Annual fee too high

- **ARTIFICIAL SCARCITY OF SPECTRUM**
  - Too little spectrum released
  - Spectrum roadmap uncertain

- **BAD AWARD RULES**
  - Enterprise value at risk
  - Incentives to foreclose competition
**Make It to the Effective Pricing Zone**

- **A** (value of lowest winner)
- **B** (true market value)
- **C** (cost recovery)

**Effective Pricing Zone** – trade off between:
- **higher prices** (more revenues but higher burden on operators and their customers)
- **lower prices** (lower financial burden but less revenues and demand reduction concerns)

- Spectrum will go unsold (award failure), as marginal winners cannot afford spectrum
- Spectrum may sell, but with maximum risk and financial burden on operators, and associated disincentives for competition and investment
- Absent positive externalities, governments should not proceed on these terms, as revenues do not cover the costs of the award
6. Licence conditions should be used with caution
7. Licence duration should be at least 20 years to incentivise network investment
8. Competition can be supported by licensing as much spectrum as possible and limiting barriers
9. Voluntary spectrum trading should be encouraged to promote efficient spectrum use
Best practice in mobile spectrum licensing

1. Auctions can deliver strong social benefits as long as they are properly designed
2. A presumption of licence renewal encourages long-term network investment
3. High spectrum prices jeopardise the effective delivery of wireless services
4. Predictable and timely spectrum licensing encourages long-term network investment
5. Licences should be technology and service neutral
Remember These Key Takeaways

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Effective Spectrum Pricing – read more about it

http://www.gsma.com/spectrum/effective-spectrum-pricing/
Spectrum Best Practice – Read More About It