Session 1: 5G Challenges

Presentation for:
Symposium on Spectrum 5.0:
New Directions for Spectrum Awards for 5G
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* This presentation is based on joint work with Prof Johannes Bauer, Michigan State University. A full paper entitled Roles and Effects of Access Regulation in 5G Markets (2018) is available http://ssrn.com/abstract=3246177
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Capex per inhabitant in US$ (2018-2020 estimated)

Source: GSMA Intelligence, World Bank World Development Indicators; own calculations.

Note: If the EU14 invested the same amount per capita as the United States, total capital expenditures in 2020 would be $27 billion higher. Over the five-year period between 2020 and 2025, when capex will predominantly support 5G network deployment, the accumulated investment gap could be more than $100 billion.

EU14 is here Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom
4G and anticipated 5G adoption per 100 inhabitants (2018-2025 estimated)

Source: GSMA Intelligence; World Bank World Development Indicators; own calculations.

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## Policy mix of the three scenarios

<table>
<thead>
<tr>
<th>Entrepreneurship</th>
<th>Regulated competition</th>
<th>Policy-push</th>
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<tbody>
<tr>
<td>• Regulation provides a framework for competition</td>
<td>• Remedies after SMP test</td>
<td>• Regulated MVNO access</td>
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<td>• Market power is primarily addressed using competition law</td>
<td>• Network neutrality</td>
<td>• Mandated openness/API access</td>
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<tr>
<td>• Other public interest goals addressed with ex post regulation</td>
<td>• Complementary program to achieve universal coverage</td>
<td>• Network neutrality</td>
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<td>• Network differentiation and service differentiation permitted</td>
<td>• Licensed and unlicensed spectrum</td>
<td>• Regulated backhaul</td>
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<td>• Framework for network and spectrum sharing agreements</td>
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<td>• Rollout obligations in license</td>
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<td>• Complementary program to achieve universal coverage</td>
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<td>• Mandated civil engineering sharing</td>
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<td>• Mandated networks/spectrum sharing</td>
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<td>• Regionally differentiated spectrum assignments</td>
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<td>• Proactive role of public sector</td>
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Extra slides
Problem Setting:
Regulatory Models for the EU for Wireless

Wireless CAPEX in Europe Versus the U.S.
2007 = 100

Source: Mobile Wireless Performance in the EU & the US by Eisenhardt, Caves and Bohlin, 2013
Framework Driving the Scenario Analysis (I)
Framework Driving the Scenario Analysis (II)

P1, P2 ... interrelated players (e.g., network operators, application developers);
\( a^{p1}, a^{p2} \) ... charges between players (may be positive, negative, or zero)