

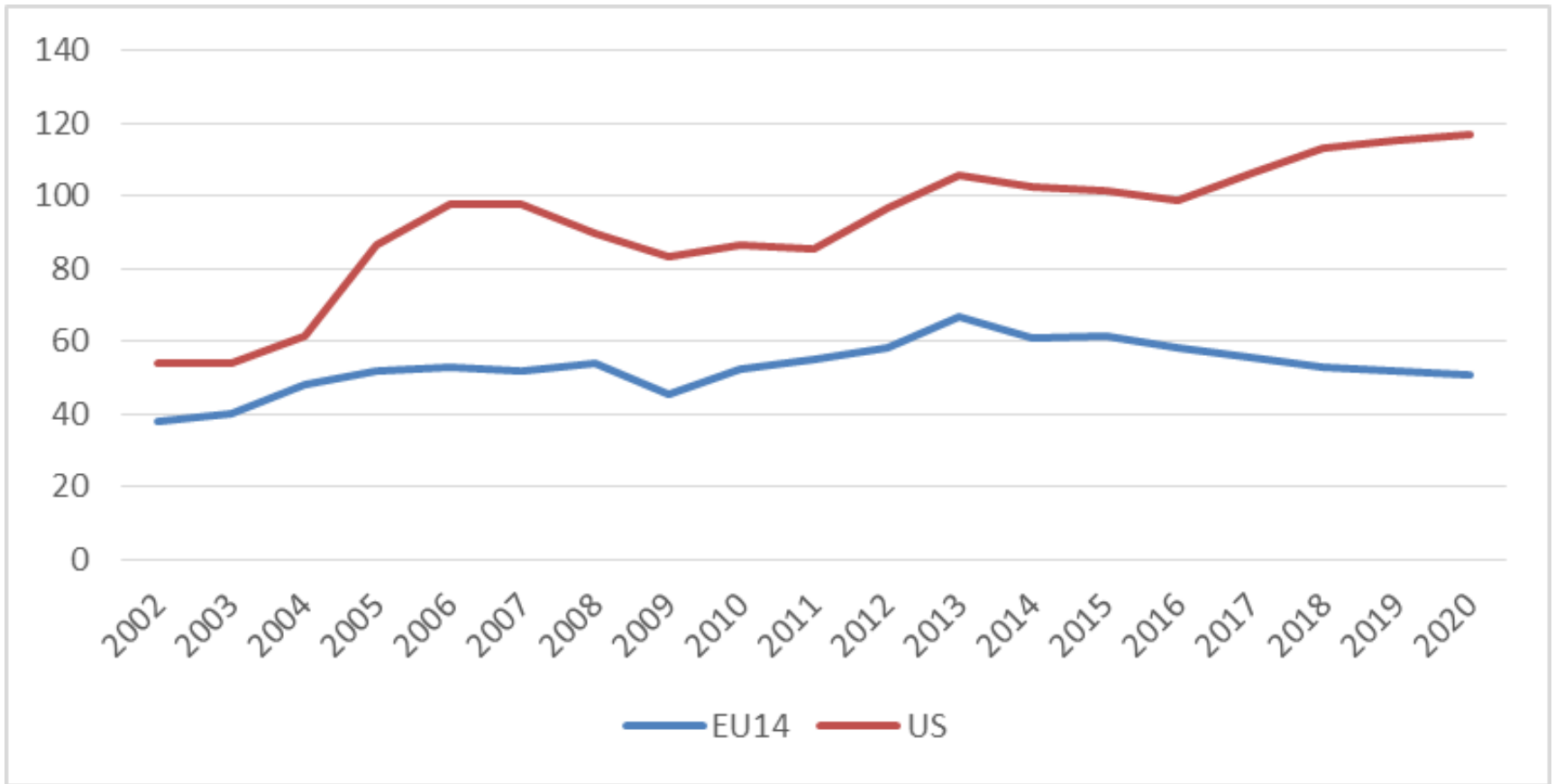
Session 1: 5G Challenges

Presentation for:
Symposium on Spectrum 5.0:
New Directions for Spectrum Awards for 5G
Convened by
Telecom ParisTech
Amphi Tech
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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)

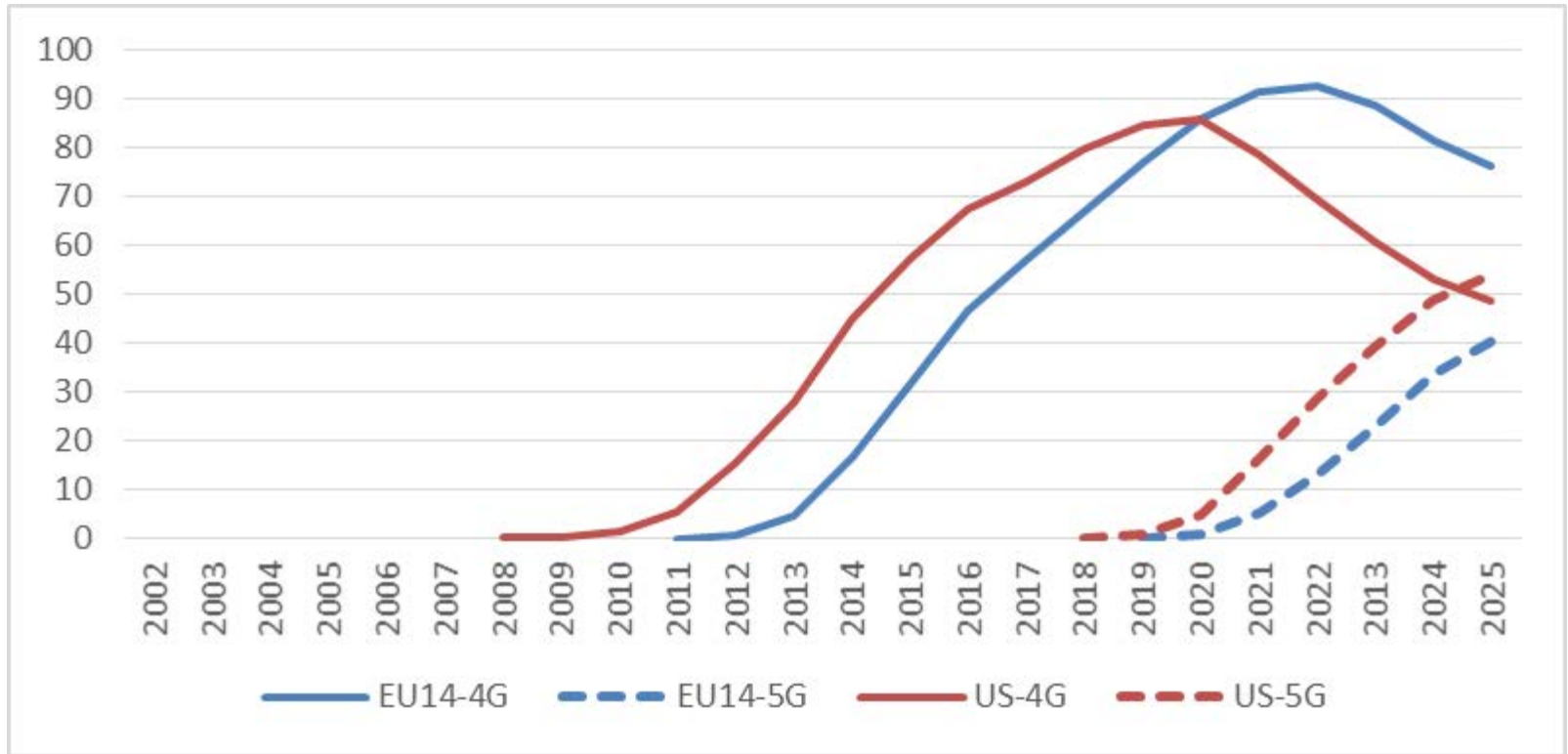


Source: GSMA Intelligence, World Bank World Development Indicators; own calculations.

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.

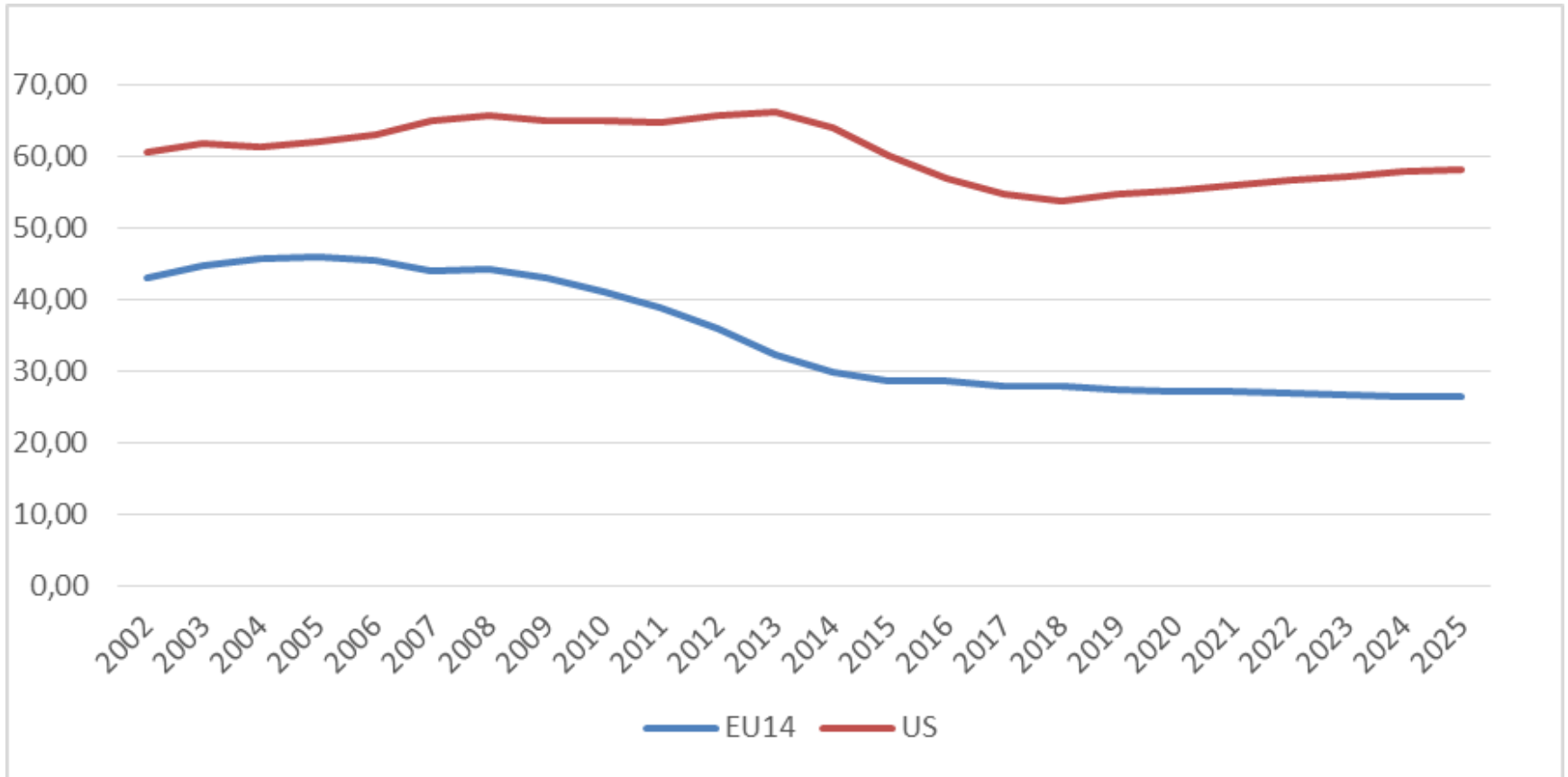
EU14 is here Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and United Kingdom

4G and anticipated 5G adoption per 100 inhabitants (2018-2025 estimated)



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

Monthly ARPU in US\$ (2018-2025 estimated)



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

Policy mix of the three scenarios

Entrepreneurship	Regulated competition	Policy-push
<ul style="list-style-type: none">• Regulation provides a framework for competition• Market power is primarily addressed using competition law• Other public interest goals addressed with ex post regulation• Network differentiation and service differentiation permitted• Framework for network and spectrum sharing agreements• Complementary program to achieve universal coverage	<ul style="list-style-type: none">• Remedies after SMP test• Network neutrality• Complementary program to achieve universal coverage• Licensed and unlicensed spectrum• Framework for network and spectrum sharing agreements	<ul style="list-style-type: none">• Regulated MVNO access• Mandated openness/API access• Network neutrality• Regulated backhaul• Rollout obligations in license• Mandated civil engineering sharing• Mandated networks/spectrum sharing• Regionally differentiated spectrum assignments• Proactive role of public sector

Extra slides



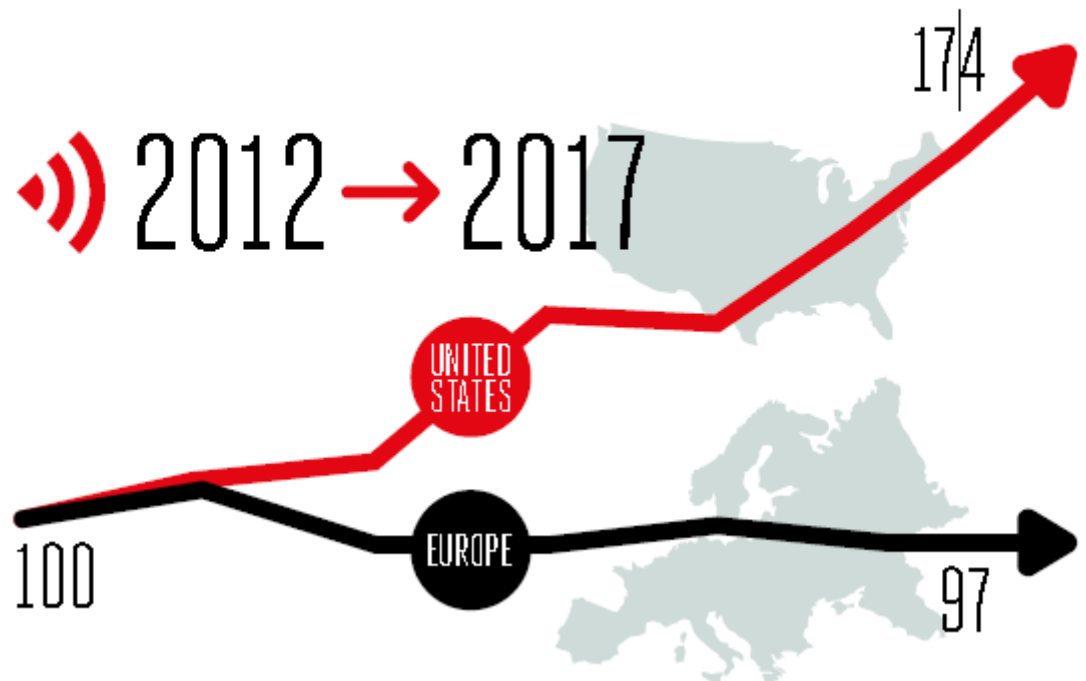
Mobile Wireless Performance in the EU & the US

MAY 2013

Problem Setting: Regulatory Models for the EU for Wireless

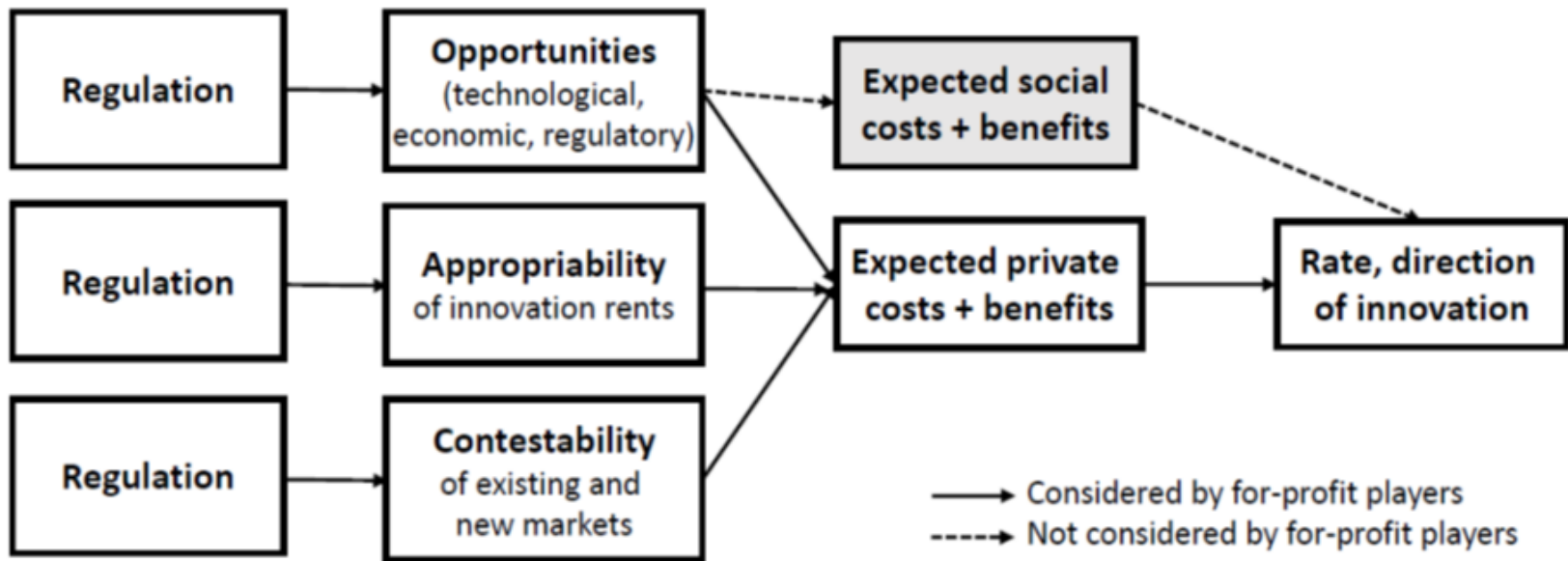
WIRELESS CAPEX IN EUROPE VERSUS THE U.S.

2007 = 100

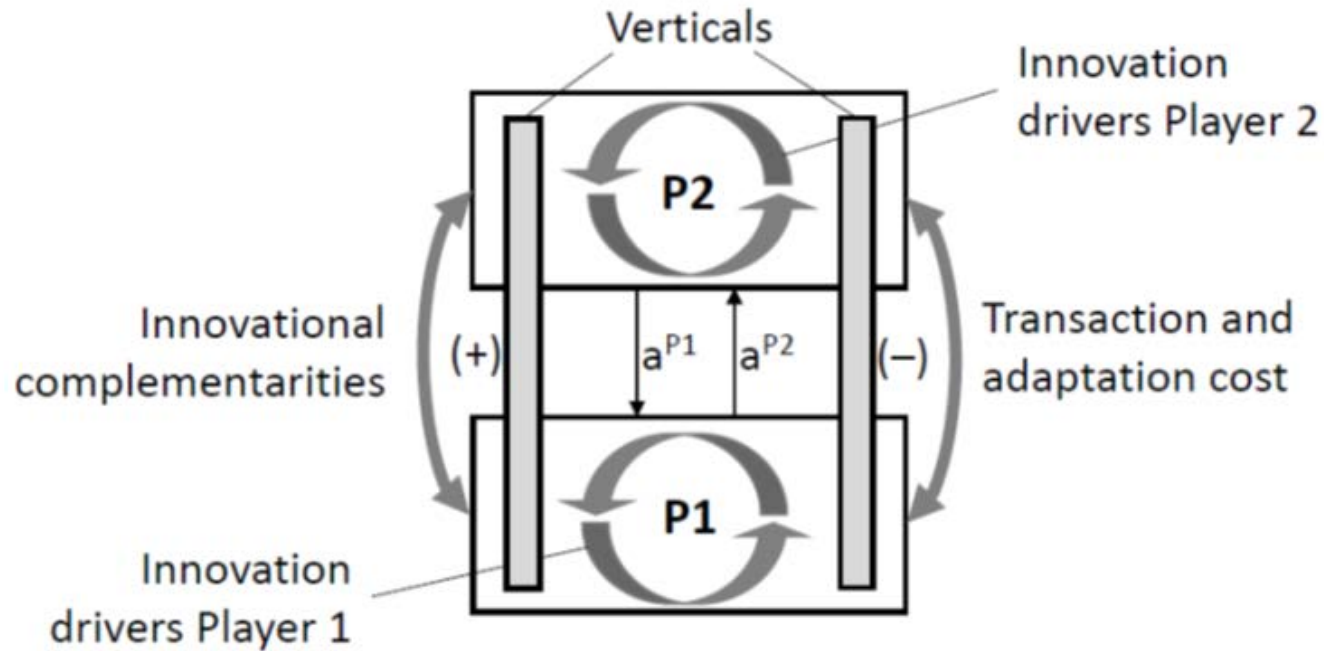


Source: Mobile Wireless Performance in the EU & the US by Eisenhardt, Caves and Bohlin, 2013

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)