



Rural/Urban Divides in Mobile Coverage Expansion

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Presentation Plan

- Research Questions
- Background
- Global and Regional Mobile Coverage Estimates
- Mobile Coverage and Market Liberalization
- Results
- Discussion



Benefits of Mobile Coverage

- Hypothesized commercial benefits of mobile phone coverage:
 - Reduces price heterogeneity across markets (Aker, 2010; Aker & Fafchamps, 2010; Jensen, 2007; Rashid & Elder, 2009)
 - Provides direct price, weather and other valuable information to farmers (Aker & Mbiti, 2010; Dillon, 2011; Gakuru, Winters, & Stepman, 2009; Fafchamps, & Minten, 2010; Camacho & Conover, 2012; Nakasone, 2014)
 - Facilitates financial transactions through mobile money (Kendall & Voorhies, 2014; Blumenstock, Eagle, & Fafchamps, 2014; Aker, 2014; Must & Ludewig, 2010; Scott, Batchelor, Ridley, & Jorgensen, 2004)
- The World Bank (2012) details evidence of benefits from mobile technology in agriculture, health, finance, economic development, governance, education, and gender equality



<http://www.agriculturesnetwork.org/magazines/india/education-for-change/e-arik-center/fieldrecordingwithmobile.jpg>

Drivers and Barriers of Mobile Coverage Expansion

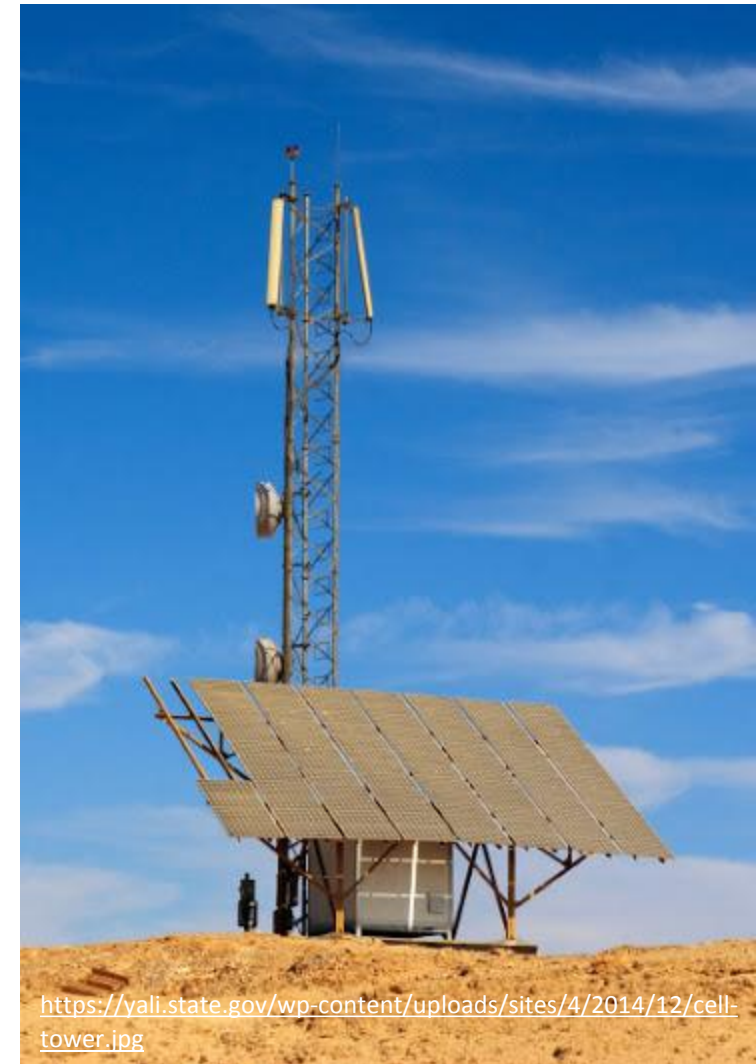
- **Demand factors:** population density, per capita income (Aker & Mbiti, 2010; Buys et al., 2009; World Bank, 2012)
- **Cost drivers:** difficult geography (e.g., higher elevation), remoteness - distance from main roads, urban centers, and electricity grids (Williams, Mayer, & Minges, 2011; Bhavnani et al., 2008)
- Several studies contend that market liberalization and increased competition between network providers is needed to expand mobile coverage (World Bank, 2012; Williams, Mayer, & Minges, 2011; Aker & Mbiti, 2010; Buys et al., 2009; Bhavnani et al., 2008; Donner, 2008; Stovring, 2004; Varoudakis & Rossotto, 2004; Ibarguen, 2003; Wallsten, 2001)
- Market liberalization alone is likely not sufficient to achieve universal mobile coverage (GSMA, 2015; Williams, Mayer, & Minges, 2011; Buys et al., 2009; World Bank, 2006; Dymond & Oestmann, 2003)
 - Coverage expansion will likely be concentrated in areas with relatively dense populations (Buys et al., 2009), leaving a “true access gap” for populations that will not be served even under optimal, efficient, and liberalized market conditions (Dymond & Oestmann, 2003)



<http://www.ukmobilereview.com/wp-content/uploads/2012/07/mobile-mast.jpg>

Estimates of Mobile Coverage

- An estimated 90% of the overall global population had mobile coverage in 2010 (World Bank, 2012)
 - Significant gains in coverage in low- and middle-income countries surveyed, from 82% in 2005 to 91% in 2010
- Continued coverage expansion in developing countries
 - Annual growth in unique mobile phone subscriptions below 1% in Europe and North America, but nearly 12% in sub-Saharan Africa in 2014 (GSMA, 2015)
 - Estimated 60% of the population with mobile coverage in sub-Saharan Africa in 2008, compared to 10% in 1999 (Center for Global Development, 2010)



Research Questions

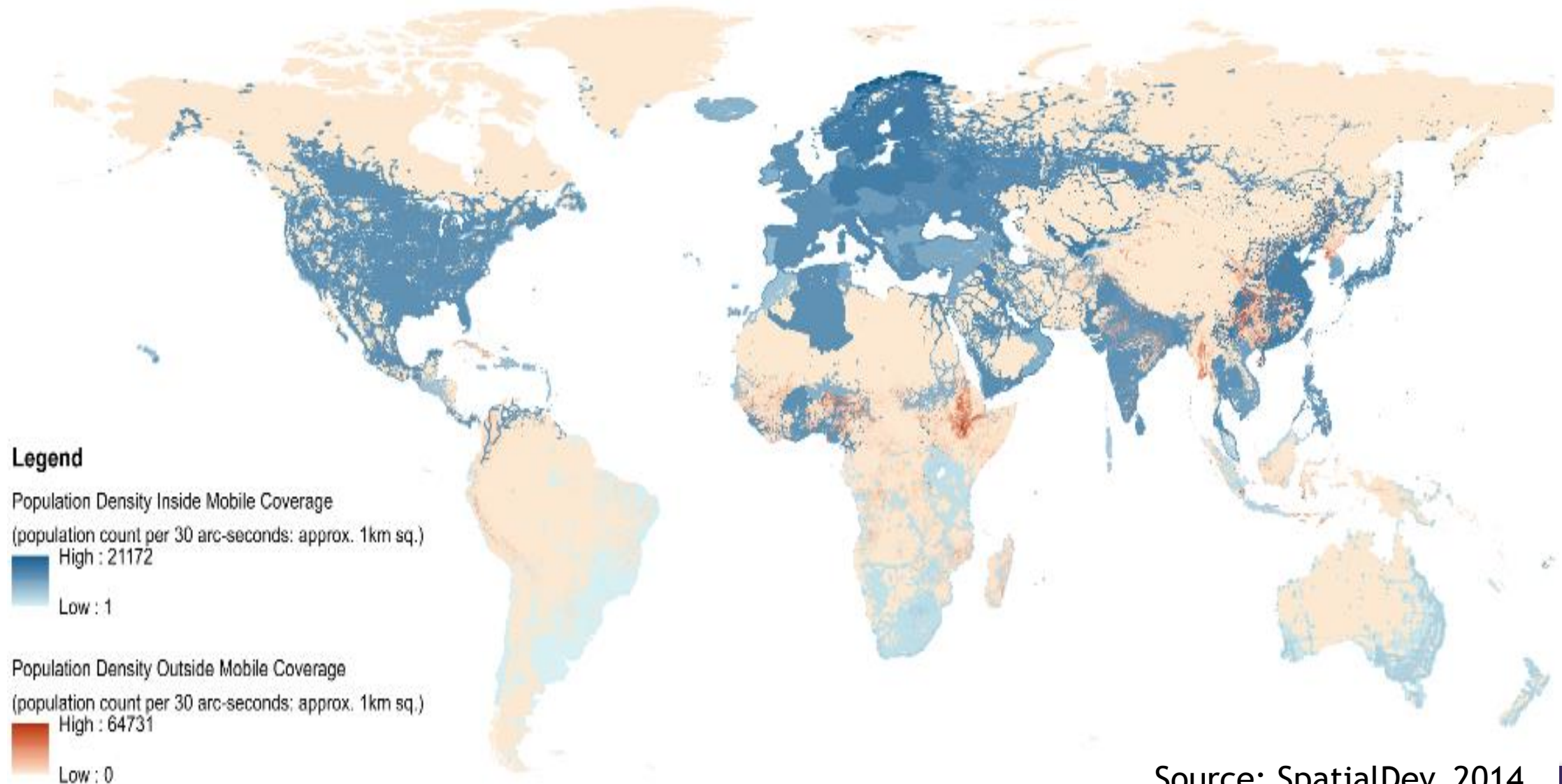
1. *What is the current extent of global mobile coverage?*
2. *What are the trends in global and regional mobile coverage expansion, and how do they differ for rural and urban populations?*
3. *Is market liberalization associated with higher levels of mobile coverage?*



Methods: 2012 Mobile Coverage Estimates

- Spatial analysis provided by SpatialDev (2014)
- Private 2012 mobile coverage data from Collins Bartholomew
 - GSMA coverage data supplemented by data obtained directly from telecommunications companies and regulators
- LandScan 2012 High Resolution Global Population Data Set and Global Rural-Urban Mapping Project (GRUMPv1) data on population densities
- Layer population density over the coverage data to estimate the number and proportion of people living inside and outside of mobile coverage areas

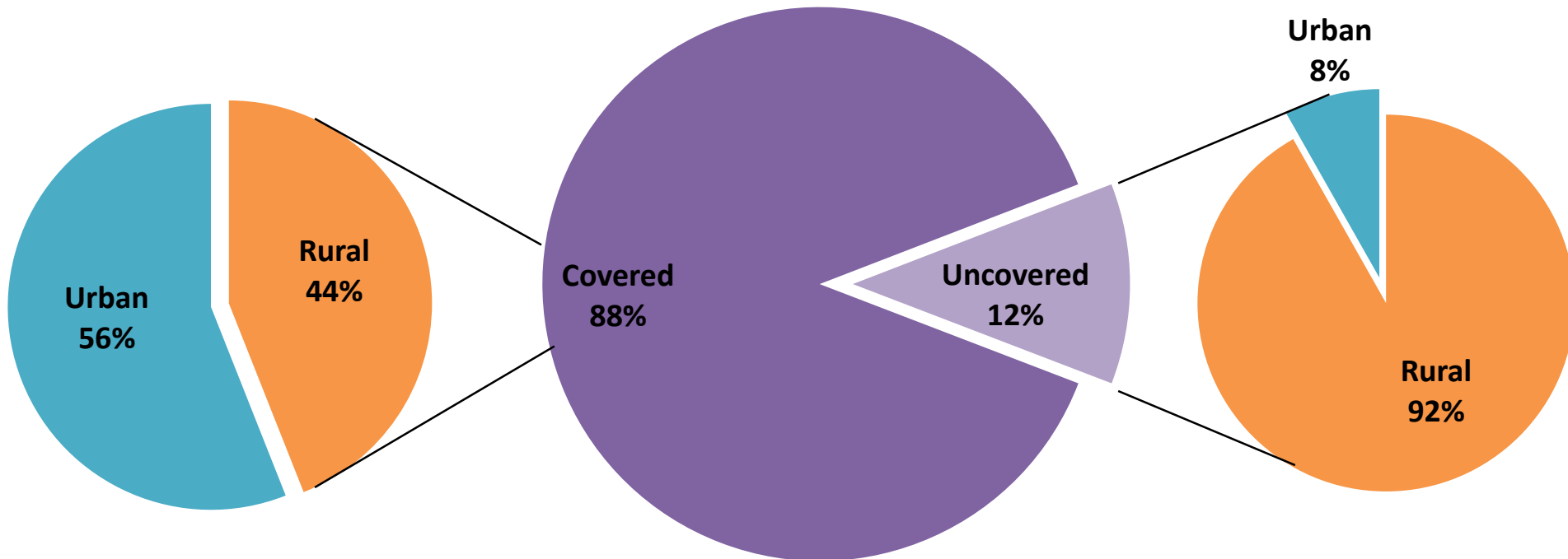
Global Population Densities of Areas With and Without Mobile Coverage



Source: SpatialDev, 2014

Global Coverage Snapshot

- 12% of the world's population lives in areas without mobile coverage.
- Of the 88% that live within mobile coverage, 44% live in rural areas.
- Of those that are uncovered, 92% live in rural areas.





Regional Mobile Coverage Estimates

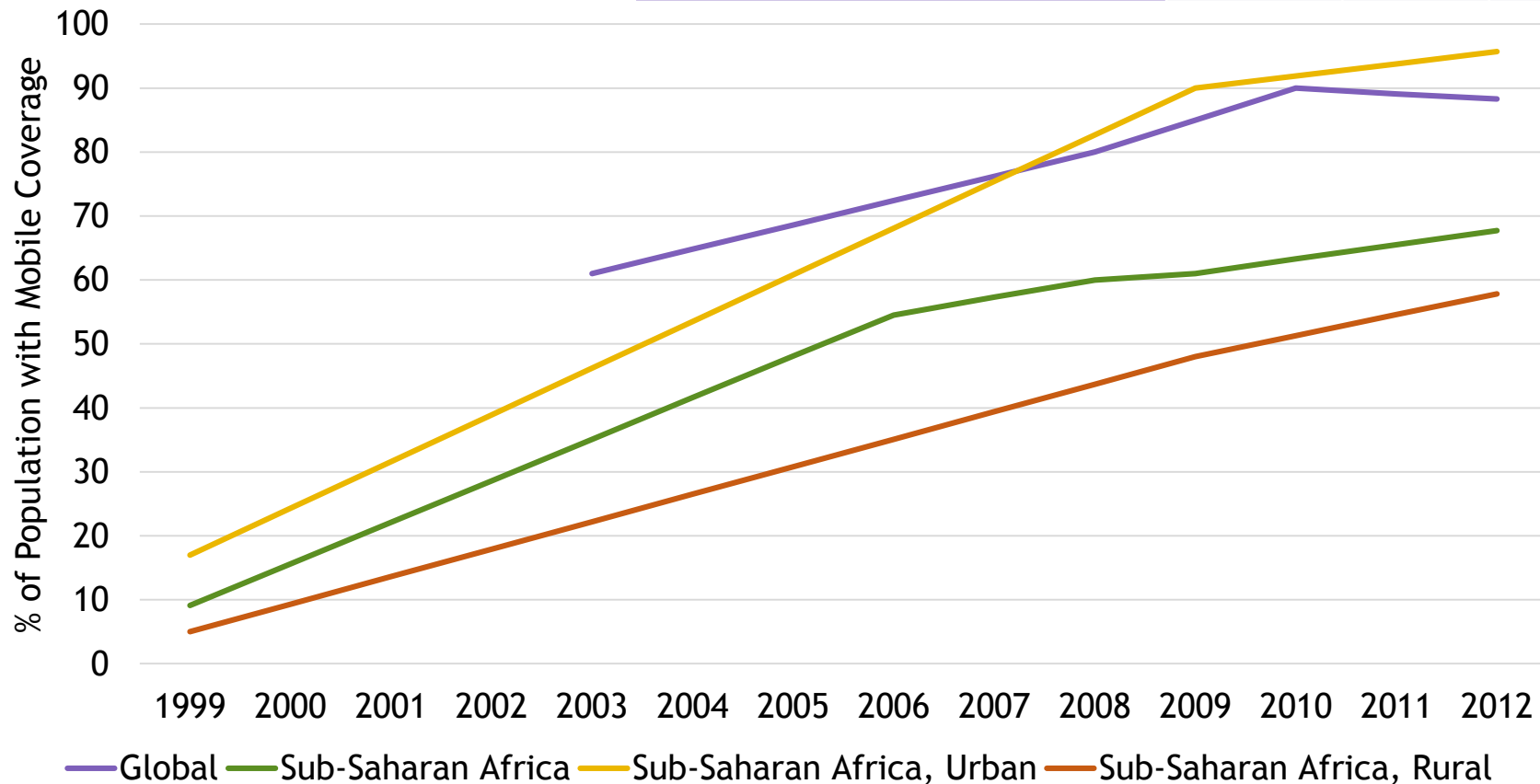
Region	Percent of World's Population Living Outside Coverage	Number of People in Region Living Outside of Coverage (Millions)	Percent of Population in Region Outside Coverage	Percent of Rural Population in Region Outside Coverage	Percent of Urban Population in Region Outside Coverage
West Africa	9.7%	79.2	24.6%	34.2%	1.4%
Southern Africa	1.7%	13.7	14.7%	26.7%	0.5%
Central Africa	8.1%	66.2	45.6%	61.7%	4.7%
East Africa	14.6%	119.4	39.5%	44.5%	13.2%
North Africa	1.1%	8.9	4.4%	11.3%	0.4%
Central America & Caribbean	1.1%	9.4	11.1%	20.0%	4.0%
South America	5.4%	44.4	11.2%	33.5%	2.4%
South Asia	17.0%	139.3	8.0%	12.0%	1.4%
Southeast Asia	11.1%	90.8	14.7%	22.0%	3.7%
Total, Selected Regions	69.6%	571.3	-	-	-



Trends in Mobile Coverage Expansion

Estimates of the Percentage of the Population with Mobile Coverage, 1999-2012

Year	1999	2003	2006	2008	2009	2010	2012
Global		61 ^c		80 ^d		90 ^c	88.3 ^f
Sub-Saharan Africa	9.1 ^{a,b}		54.5 ^a	60 ^e	61 ^b		67.7 ^f
Sub-Saharan Africa, Urban	17 ^b				90 ^b		95.7 ^f
Sub-Saharan Africa, Rural	5 ^b				48 ^b		57.8 ^f



Sources:

- ^a Buys et al., 2009
- ^b Williams et al., 2010
- ^c World Bank, 2012
- ^d Bhavnani et al., 2008
- ^e Aker & Mbiti, 2010
- ^f Original estimates

Note: In the graph, values for years with no coverage data were estimated using the average change in mobile coverage between the years where coverage data estimates were available.

Indicators of Market Liberalization

- Number of mobile network operators (MNOs):
 - Nationwide “licensed mobile cellular service providers that have their own network infrastructure as opposed to other mobile service providers who lease it” (World Bank, 2012)
- Herfindahl-Hirschman Index (HHI) for the Mobile Industry:
 - Measures the size of firms in relation to a particular industry
 - A higher HHI indicates greater market concentration, or lower levels of competition
- CPIA Business Regulatory Environment (BRE) Rating:
 - Assesses “the extent to which the legal, regulatory, and policy environments help or hinder private businesses in investing, creating jobs, and becoming more productive”
 - A higher BRE rating indicates a highly supportive regulatory environment for business activity

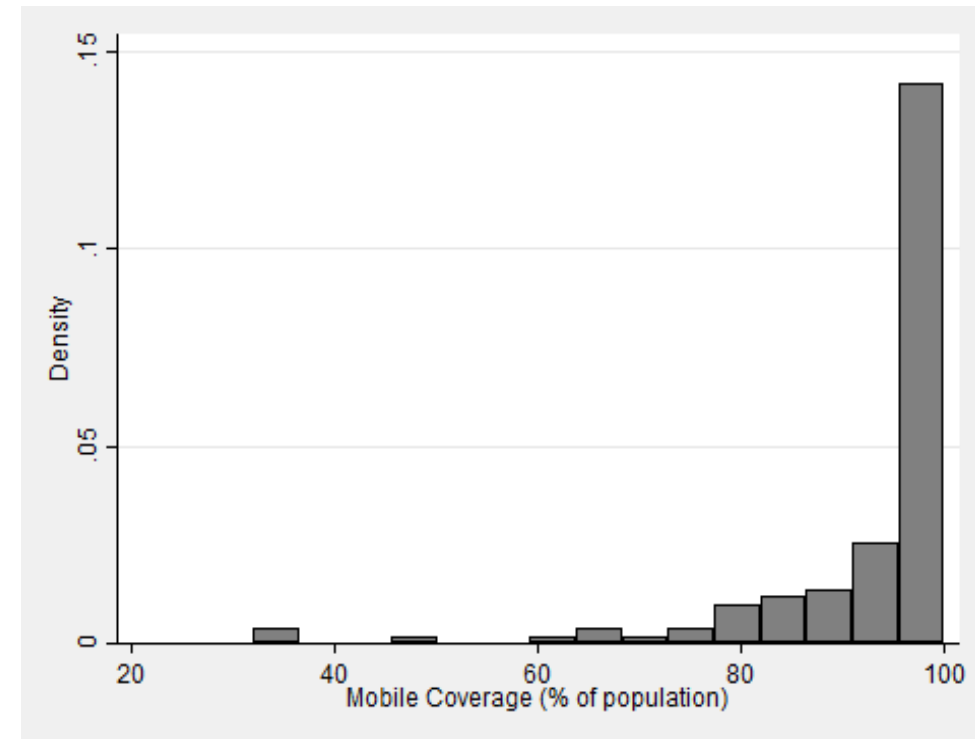
Correlates of Mobile Network Coverage

Indicators of Demand Factors and Cost Drivers

- Gross National Income (GNI) per capita:
 - Wealthier populations likely have greater willingness to pay for mobile coverage
 - Countries with higher GNI per capita may also have more supporting infrastructure, reducing costs of coverage expansion
- Rural Proportion of the Population:
 - Costs of expanding coverage in rural areas is greater due to distance from supporting infrastructure
 - Increases in geographic area covered lead to smaller increases in the proportion of the population that is covered

Summary Statistics

Variable	N	Mean	Std. Dev.	Min.	Max.
CPIA BRE Rating	36	3.3	0.8	1.5	5.5
GNI per capita (2010 US\$)	109	14,043	17,601	170	87,350
Rural Population (% of Total)	109	40.2	22.5	0	89
Number of Mobile Operators	109	3.4	1.2	1	8
Mobile Herfindahl-Hirschman Index (HHI)	103	4,115	1,409	1,393	10,000
Mobile Coverage (% of the Total Population)	112	93.1	12.4	32	100



- 2010 data on mobile coverage, mobile network liberalization, and market size
 - CPIA BRE Rating: World DataBank (2012)
 - All other variables: World Bank “Maximizing Mobile” report (2012)
- 43 countries in the “Maximizing Mobile” dataset do not have mobile coverage data
 - Most of these are developing countries

Indicators of Market Liberalization at Different Levels of Mobile Coverage

Level of Mobile Coverage	Number of Countries	Average Mobile Coverage	Number of MNOs (n=109)			
			Minimum	Maximum	Median	Mean
100 %	40	100	1	5	3	3.2
95-99 %	35	97.9	2	7	3	3.5
90-94 %	14	91.4	1	5	3	3.4
80-89 %	11	83.2	2	8	4	4.2
<80 %	9	60.0	1	5	3	3.2

Level of Mobile Coverage	Number of Countries	Average Mobile Coverage	Mobile Herfindahl-Hirschman Index (HHI) (n=103)			
			Minimum	Maximum	Median	Mean
100 %	39	100	2,495	6,429	3,780	3,921
95-99 %	34	97.9	2,354	6,800	3,718	3,907
90-94 %	12	91.5	2,282	10,000	3,655	4,955
80-89 %	11	83.2	1,393	5,625	3,871	2,899
<80 %	7	57.1	3,242	10,000	4,826	5,141

Level of Mobile Coverage	Number of Countries	Average Mobile Coverage	CPIA BRE Rating (n=36)			
			Minimum	Maximum	Median	Mean
100 %	2	100	4	4	4	4
95-99 %	6	98.2	3.5	5.5	4	4.2
90-94 %	9	91.3	2	4	3.5	3.3
80-89 %	11	83.2	2	4.5	3.5	3.2
<80 %	8	58.3	1.5	4.5	3	2.8

Results: Pairwise Correlation

Variables	Mobile Coverage (% of the total population)	Number of MNOs	Herfindahl-Hirschman Index (HHI)	CPIA BRE Rating	GNI per capita	Rural Population (% of Total)
Mobile Coverage (% of the Total Population)	1					
Number of MNOs	-0.0509 (109)	1				
Herfindahl-Hirschman Index (HHI)	-0.1565 (103)	-0.6919 (103)	1			
CPIA BRE Rating	0.4671 (36)	0.1860 (35)	-0.2804 (33)	1		
GNI per capita	0.3781 (109)	-0.1210 (106)	-0.1657 (100)	0.4769 (36)	1	
Rural Population (% of Total)	-0.4558 (109)	0.2220 (106)	0.1605 (103)	-0.3278 (34)	-0.5753 (106)	1

Results: One-way ANOVA

Results of one-way ANOVA for mobile coverage and indicators of market liberalization, demand factors, and cost drivers

Variable	SS	df	MS	F	Prob > F
Number of MNOs	1072.7	4	268.2	1.83	0.128
Mobile HHI	1274.9	4	318.7	2.27	0.068
CPIA BRE Rating	3778.8	4	944.7	5.06	0.003
GNI per capita	5715.8	4	1429.0	13.37	0.000
Rural Population (% of Total)	3695.9	4	924.0	7.95	0.000



Conclusions

- Mobile coverage expansion rates are slowing; of the 11.7% of the world's population without mobile coverage, 91.8% are located in rural areas
- Mobile-specific market liberalization will likely not be sufficient to achieve full mobile coverage
- More general market liberalization to promote competitiveness in both the mobile industry and in complementary industries may support coverage expansion
- Mobile coverage is most strongly associated with potential financial returns (incomes of populations) and costs of coverage expansion (remoteness of populations)
- In the absence of significant increases in rural income or decreases in the costs of reaching rural populations, some form of government support or subsidy may be required (Williams, Mayer, & Minges, 2011)



<http://s1.ibtimes.com/sites/www.ibtimes.com/files/styles/md/public/2015/10/mobile-phones.jpg>



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Please direct comments or questions about this research to Principal Investigators C. Leigh Anderson and Travis Reynolds at epar.evans.uw@gmail.com.