THE ECONOMIC VALUE OF WI-FI: A GLOBAL VIEW

A study commissioned by Wi-Fi Alliance

Raul L. Katz

Telecom Advisory Services, LLC

Berlin, Germany– November 7, 2018

HY IS IT IMPORTANT TO ASSESS THE ECONOMIC VALUE OF WI-FI?

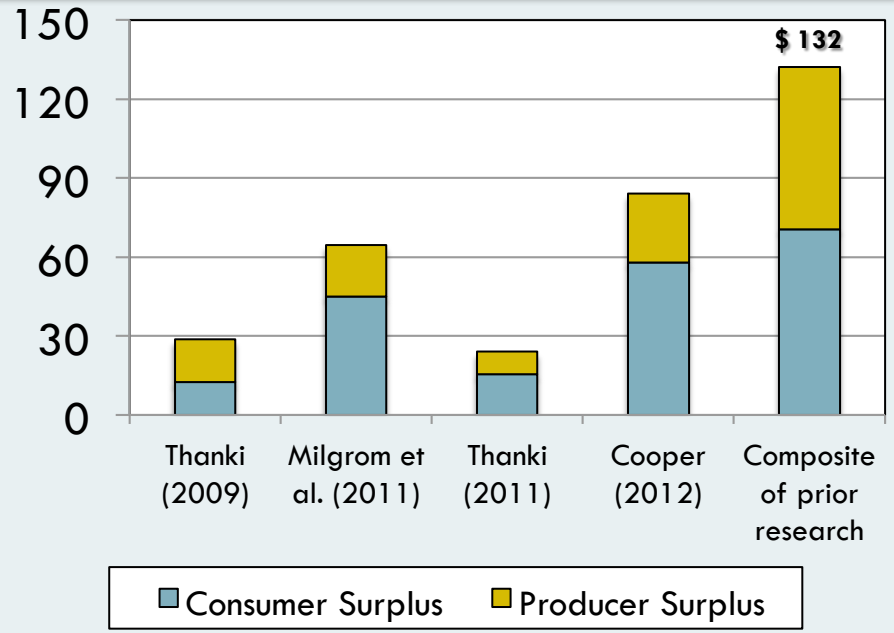
	WORLD	EUROPE
Residential Use[1]	• 800 million households	• UK: 85% of households • France: 92% of households
Time on Wi-Fi vs. Cellular[2]	• 63% in China • 58% in Brazil • 51% in Australia	• 60% in UK • 47% in France • 62% in Germany
Number of hotspots[3]	• 12 million commercial • 329 million community - based	• UK: 14 million • France: 23 million • Germany: 21 million

Strategy Analytics; Telecompetitor
OpenSignal
iPass Wi-Fi Growth Map

E MEASUREMENT OF ECONOMIC VALUE OF WI-FI IS A COMPLEX TASK

- Wi-Fi is used by numerous devices and services
- In some cases, services are offered as a free good to consumer (how does one quantify the willingness to pay?)
- The diffusion of innovations relying on Wi-Fi is proceeding at an extremely fast pace, which renders studies obsolete after a few months
- When we did our first study on unlicensed spectrum value, research on economic value was limited

PRIOR STUDIES ON VALUE OF WI-FI IN UNITED STATES

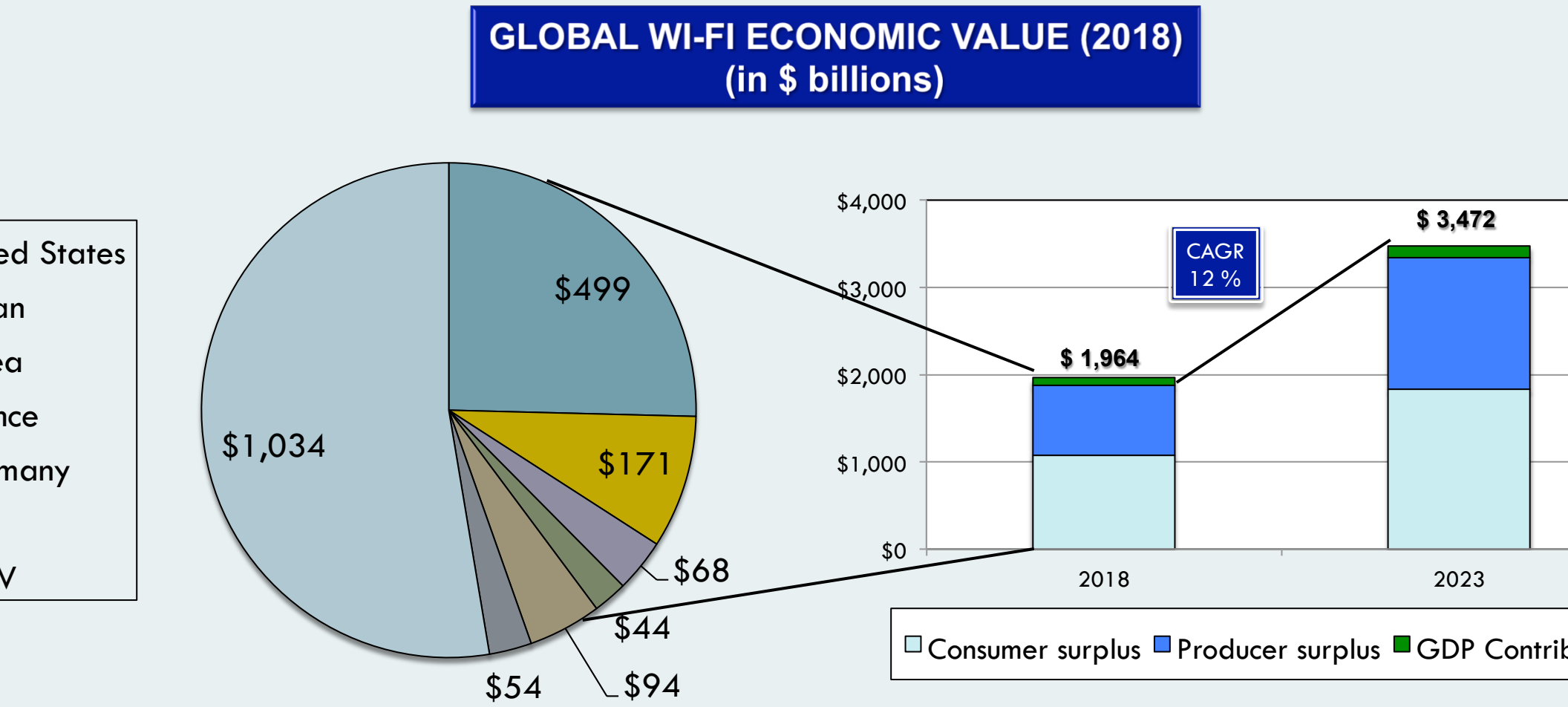


rce: Compiled by Telecom Advisory Services

PPROACHED THE MEASUREMENT OF WI-FI ECONOMIC VALUE BY QUANTIFYING EIGHT EFFECTS

hension	Consumer surplus	Producer surplus	GDP Contribution
of free Wi-Fi	• Benefit to consumers of free Wi-Fi traffic offered in public sites		
of residential	• Internet access for home usage of devices that lack a wired port (e.g. tablets, smartphones, game consoles) • Avoidance of investment in in-house wiring		
of enterprise		• Business internet traffic transmitted through Wi-Fi • Avoidance of wiring of enterprise buildings	
of cellular ng		• Total cost of ownership (cumulative CAPEX and OPEX) required to accommodate future capacity requirement with Wi-Fi complementing cellular networks	
of locally ured Wi-Fi devices	• Difference between willingness to pay and retail prices	• Difference between retail price and manufacturing costs for a weighted average of suppliers	
of bridging al divide			• Additional GDP from incrementa broadband lines in rural areas
return to			• While speed increase drives cons surplus, recent research finds eco efficiency spillovers
ues of Wi-Fi and Wi-Fi Ps			• These revenues would not exist w availability of unlicensed spectru

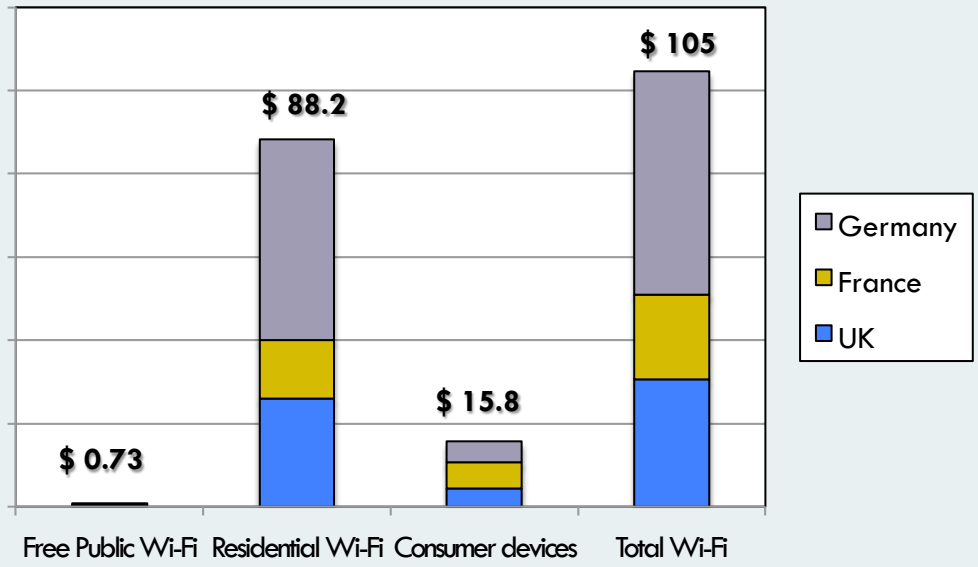
VI-FI GLOBAL ECONOMIC VALUE AMOUNTS TO $1.96 TRILLION AND WILL GROW BY 12% ANNUALLY TO REACH $ 3.47 TR BY 2023



rce: Compiled by Telecom Advisory Services

-FI TECHNOLOGY GENERATES A CONSUMER SURPLUS OF $105 BILLION IN THE UNITED KINGOM, FRANCE AND GERMANY

EUROPE: CONSUMER SURPLUS OF WI-FI (2018) (in $ billions)



f
Wi-

- Internet access for devices lacking wired port
- Avoidance of investment in in-house wiring

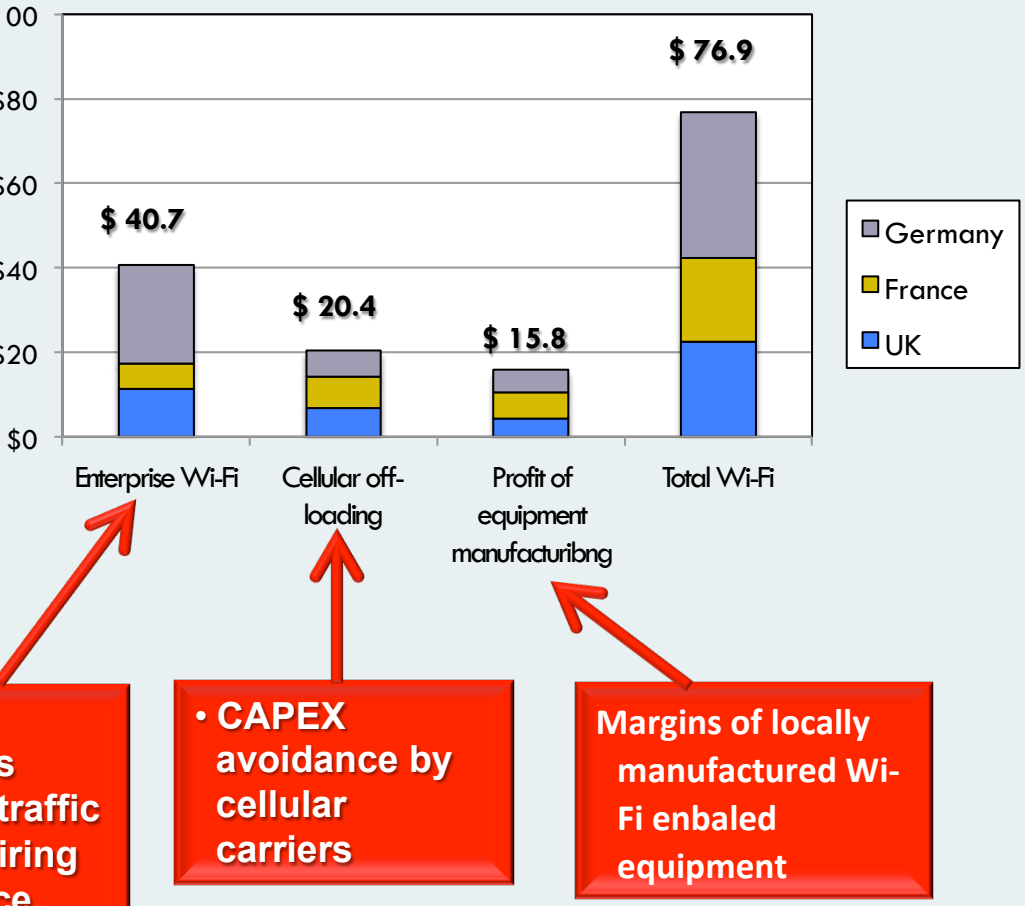
Willingness to pay of Wi-Fi enabled equipment

	U. K.	France	Ge
Smartphone penetration	93.8 %	80.6 %	95
Average traffic per smartphone per month	7.24 GB	7.87 GB	4.2
Off-loading factor	58 %	65 %	4
Annual home mobile traffic (2018) (MM GB)	5,453	2,922	2
Wi-Fi households	75%	83 %	8

Telecom Advisory Services analysis

-FI TECHNOLOGY GENERATES A PRODUCER SURPLUS OF $76.9 BILLION IN THE UNITED KINGOM, FRANCE AND GERMANY

EUROPE: PRODUCER SURPLUS OF WI-FI (2018) (in $ billions)

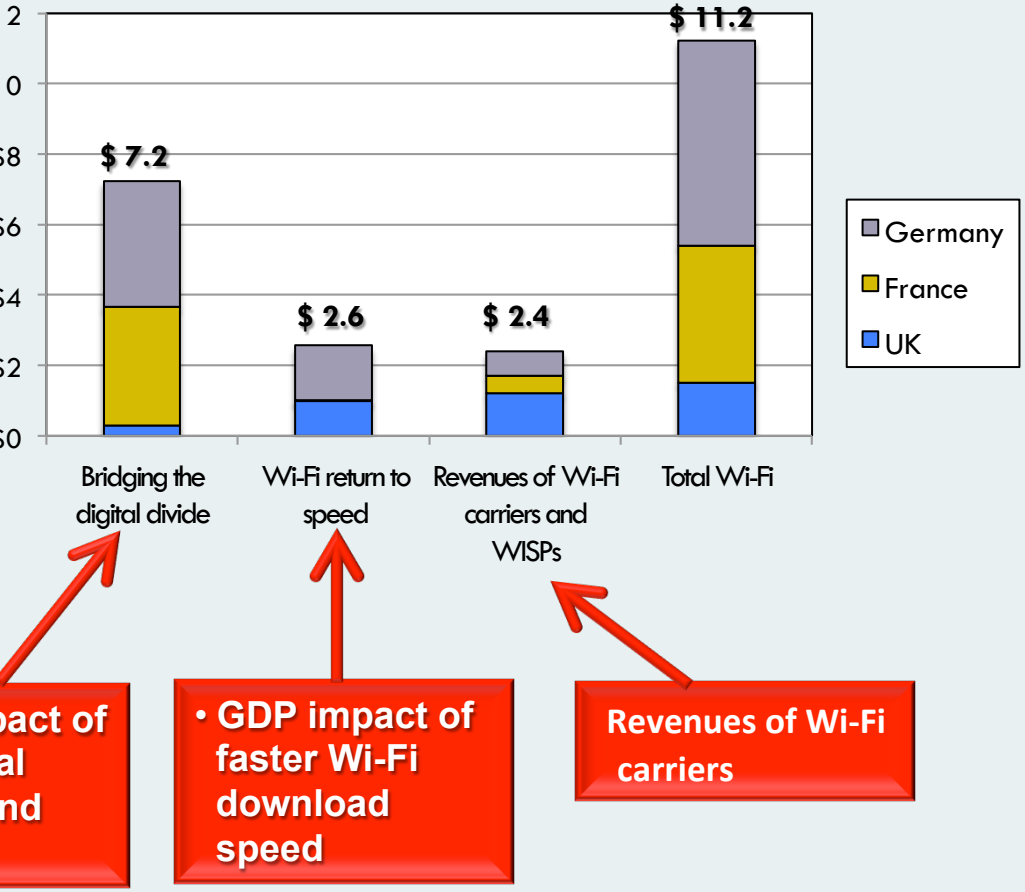


	U. K.	France	Ge
Wi-Fi business traffic (2018) (MM GB)	4,500	2,701	2
CAPEX savings by cellular off-loading ($ billion)	$ 6.84	$ 7.40	$
Margin of Wi-Fi enabled equipment ($ billion)	$ 8.66	$ 6.28	$

Telecom Advisory Services analysis

-FI TECHNOLOGY GENERATES A CONTRIBUTION TO GDP OF $11.2 BILLION IN THE UNITED KINGDOM, FRANCE AND GERM

EUROPE: WI-FI CONTRIBUTION TO GDP (2018) (in $ billions)

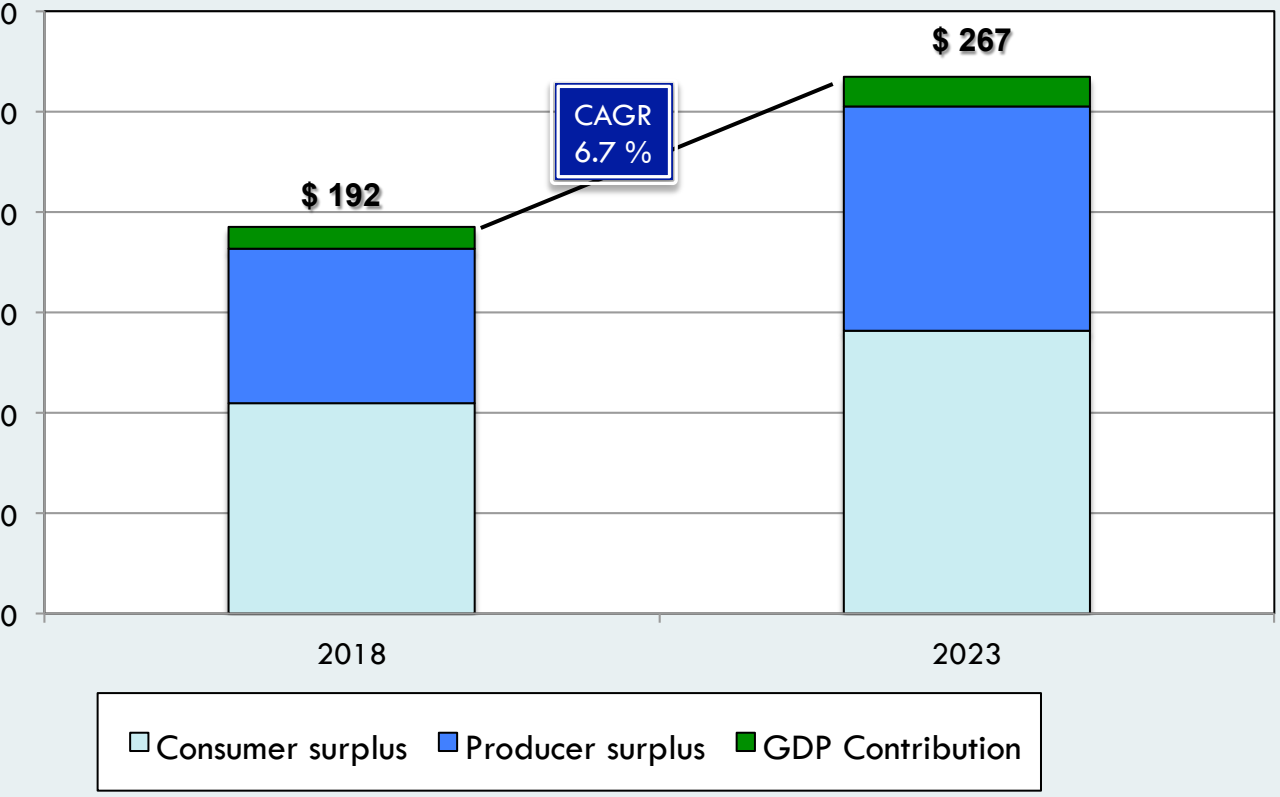


	U. K.	France	Ge
Incremental Wi-Fi enabled broadband penetration	1.25 %	3.11 %	1
Wi-Fi speed advantage (Mbps) (2018)	9.12	4.6	1
Revenues of Wi-Fi carriers ($ billion) (2018)	$ 1.22 B	$ 0.49 B	$ 0

Telecom Advisory Services analysis

E VALUE OF WI-FI IN THE THREE LARGEST EUROPEAN COUNTRIES HAS REACHED $ 192 BILLION AND IS PROJECTED TO GR
5% PER YEAR THROUGH 2023

EUROPE: ECONOMIC VALUE OF WI-FI (2018-2023) (billions)



Source: Telecom Advisory Services analysis

GERMANY

2018	2023
$94 billion	$132 billion

UNITED KINGDOM

2018	2023
$54 billion	$71 billion

FRANCE

2018	2023
$44 billion	$64 billion

I-FI IS ALSO A VERY IMPORTANT CONTRIBUTOR TO EMPLOYMENT: 111,000 IN THE UK, FRANCE, AND GERMANY

GDP contribution → **Employment**

Additional broadband lines
Faster wireless networks
Development of a Wi-Fi service provider industry

- **Direct jobs** (telecommunications industry, telecommunications equipment manufacturing)
- **Indirect jobs** (suppliers to the telecommunicat industries, such as consruction, business servi
- **Induced jobs** (triggered by consumption of dir and indirect jobs)

GDP Contribution ($ Billion) (2018)

Country	GDP
United Kingdom	$ 1.52
France	$ 3.88
Germany	$ 5.82

Employment (2018)

Country	Jobs
United Kingdom	17,000
France	29,000
Germany	65,000

NOTE: According to the ITU, FTEs for telecommunications operators in the three countries is 415,000
Source: Telecom Advisory Services analysis

G DEPLOYMENT WILL INCREASE THE VALUE OF CELLULAR OFF-LOADING

The upcoming flexible, radio-neutral 5G environment will be intrinsically supported by the next wave of 802.1
Fi standards (802.11n/ac, 802.11ax, WiGig), and short-range wireless technologies operating in unlicensed b

Announced 5G investments (UK:$56.94 billion ; Japan: $ 45.5 billion ; Germany: $ 43.9 billion)

Investment assumes savings derived from Wi-Fi technology

Investment without Wi-Fi – Investments announced = Wi-Fi CAPEX savings

Wi-Fi Economic value as resulting from 5G deployments (2023)

	Wi-Fi Economic Value (CAPEX)	Wi-Fi Economic Value (CAPEX & OPEX)
United Kingdom	$ 2.12 billion	$ 8.12 billion
France	$ 3.74 billion	$ 14.31 billion
Germany	$ 3.07 billion	$ 11.75 billion

Source: Telecom Advisory Services analysis

E POLICY IMPLICATIONS OF THIS EVIDENCE ARE SELF-EXPLANATORY

- Unlicensed spectrum, as an enabling resource, is a critical driver of innovation and value creation
- These effects, as proven through the evidence generated in the study, support a policy that preserves unlicensed spectrum
- Furthermore, given the exponential growth in utilization of technologies such as Wi-Fi, it is reasonable to consider the potential expansion of the amount of unlicensed spectrum

THE TRENDS

- Wi-Fi traffic in the Germany is growing at 19% annually
- Wi-Fi households, currently at 80%, are forecast to reach 93% by 2023
- Smartphone penetration, currently at 95%, are estimated to reach 99% million by 2023
- Wi-Fi Business traffic is growing at 24% annually

THE RISKS

- Average Wi-Fi speed does not increase, but stays at current levels (26.50 Mbps), erasing 132 billion of the Wi-Fi speed cumulative return over five years
- Wi-Fi becomes bottleneck in ultra-broadban households
- Difficulty in migrating to 5G
- Limited availability of spectrum to foster new innovative applications

TELECOM ADVISORY SERVICES, LLC

For further information please contact:

Raul Katz, raul.katz@teleadvs.com, +1 (845) 868-1653

Telecom Advisory Services LLC
139 West 82nd Street

Suite 6D

New York, New York 10024 USA