FINAL REPORT

ASSESSMENT OF THE ECONOMIC IMPACT OF TELECOMMUNICATIONS
IN THE MIDDLE EAST AND NORTH AFRICA

December 2016

Columbia Institute for Tele-Information

**Assessment of the Economic Impact of Telecommunications
in the Middle East and North Africa: Jordan, Tunisia, and Morocco**

Executive Summary[1]

The telecommunications sector generates a significant direct contribution to the economy of the countries under study, representing 3.7% of the total 2014 Gross Domestic Product:

- The telecommunications industry gross revenues comprised 3.2% of Tunisia's economy in 2014, 3.7% in Morocco and 4.3% in Jordan.
- The sector generated approximately 0.5% of the aggregate workforce of the three countries in 2013: 1% in Jordan, 0.5% in Morocco and in Tunisia.

Beyond the direct effects, telecommunications have a significant spill-over impact on the rest of the economy:

- The average contribution for every 10% increase of **mobile penetration** to the annual GDP is estimated at 1.1% of GDP growth for Tunisia, to 1.4% or Morocco, and 1.2% in Jordan.
- In particular, the average contribution to the annual GDP growth for every 10% increase in **mobile broadband** penetration ranges between an estimated 0.4% for Jordan, and 0.5% for Morocco[2].
- Finally, the average contribution to the annual GDP growth for every 10% increase in **fixed broadband** penetration is estimated at 0.7% for Jordan, 0.8% for Morocco and 1.0% for Tunisia.

As a result:

- Mobile telecommunications indirectly contributed 1.0% of the 2014 GDP in Jordan, 1.5% in Morocco, and 1.1% in Tunisia.
- Fixed broadband contributed 1.1% of the 2014 GDP in Jordan, 0.7% in Morocco, 0.5% in Tunisia.

Therefore, the combined indirect contribution represented approximately 2% of the three countries' 2014 GDP: 2.1% in Jordan, 1.5% in Tunisia, and 2.2% in Morocco, and the aggregate direct and indirect effects of the telecommunications sector represented 5.7% for the three countries' 2014 GDP: 6.4% in Jordan, 5.9% in Morocco, and 4.7% in Tunisia.

Direct and indirect contributions of telecommunications to the economy (2014)

		Jordan	Morocco	Tunisia	Total
Direct contribution to the economy	**Participation in the GDP** (2014)	4.3 %	3.7 %	3.2 %	3.7 %
	Weight in the workforce (2013)	1.0%	0.5%	0.5%	0.5 %
Spill-over impact: **Contribution to GDP growth for every 10% penetration increase**	**Mobile telecommunications**	1.2% *	1.4% *	1.1% **	
	Fixed broadband	0.7% ***	0.8% ***	1.0% ****	
Spill-over impact: **Weight in the GDP in 2014**	**Mobile telecommunications**	1.0 %	1.5 %	1.1 %	1.3 %
	Fixed broadband	1.1 %	0.7 %	0.5 %	0.7 %
Direct and Indirect impact of annual GDP (2014 estimate)		6.4 %	5.9 %	4.7 %	5.7 %

Source: Telecom Advisory Services analysis   Based on historical time series: * 2001-2014 ** 2003-2014 *** 2006-2014 **** 2009-2014

Implications

Given the economic importance of telecommunications, public policies and regulatory frameworks need to be defined in order to maximize investment in network deployment and modernization.

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[1] Executive Summary of the study "Assessment of the Economic Impact of Telecommunications in the Middle East end North Africa" December 2016) conducted for Orange by Telecom Advisory Services, LCC [Raul Katz : Director of Business Strategy Research at the Columbia Institute for Tele-Information, Fernando Callorda: Professor in the Management Department at the ESEADE (Argentina), Catherine Patel. For full reports: http://www.citicolumbia.org/index.php/publications/published-papers/2016-papers/

[2] Mobile broadband indirect contribution to economic growth is already captured within the impact of mobile telecommunications. Its more recent launch in Tunisia prevents from estimating its contribution.

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Summary of Findings

The direct positive relationship between the adoption of information and communication technologies (ICT) and economic development is largely accepted. For decades, economists, social scientists, and policy makers have examined ICT's link to such measures of economic well being as GDP growth, job creation, and productivity. In the past, primarily due to limited data availability, studies assessed telecommunications economic contribution by examining cross-sectional samples of countries at the aggregate level. More recently, however, with additional statistical information at its disposal, research has added a new dimension to the field, focusing on estimating the economic impact of telecommunications, more specifically fixed broadband, within a single country. Finally, given the availability of a sufficient number of statistical observations regarding wireless broadband adoption, research has now turned to assess the economic impact of mobile data communications. Along these lines, the purpose of this study is to quantitatively estimate the contribution of wireless telecommunications, mobile and fixed broadband to three Middle eastern and North African economies: Jordan, Tunisia, and Morocco. These estimates serve as a basis to make policy recommendations that will maximize such contribution.

This study finds that the overarching consensus – that ICT adoption encourages economic growth – also holds true for the three countries under study, where it has impacted the economy and employment while allowing the countries to benefit from many positive externalities. The direct effects of telecommunications on the economies of Jordan, Tunisia and Morocco are sizable. Total revenues generated by the telecommunications industries of the three countries amount to US$ 7,140 million, which represent 3.68 % of the countries' combined GDP (see table A).

Table A. MENA Countries: Telecommunications Industry Revenues (2014)

	Revenues (USD '000'000)				GDP (USD '000'000)	Percent of GDP
	Fixed Telephony	**Fixed Broadband**	**Mobile Telephony**	**Total**		
Jordan	$ 526	$ 79	$ 918	$1,523	$ 35,765	4.26 %
Tunisia	$ 329	$ 35	$ 1,181	$ 1,545	$ 48,533	3.18 %
Morocco	$ 27	$ 122	$ 3,923	$ 4,072	$ 109,201	3.73 %
Total	$ 882	$ 236	$ 6,022	$ 7,140	$ 193,499	3.68 %

Sources: International Telecommunications Union; GSMA Intelligence; Telecom Advisory Services analysis

In addition to its direct monetary contribution to the economy, the telecommunications industry also fuels job creation. In 2013, the telecommunications sector of the three countries under study generated 28,714 direct jobs (within the respective service providers), and an estimated 59,710 indirect jobs (employed by suppliers of inputs to the industry) (see table B).

Table B. MENA Countries: Telecommunications Industry Employment (2013)

	Direct jobs	Indirect Jobs (*)	Direct and Indirect Jobs (*)	Country Workforce	Percent of Total Workforce
Jordan	4,214	7,710	11,924	1,198,000	1.00 %
Tunisia	11,000	10,000	21,000	3,978,000	0.53 %
Morocco	13,500	42,000	55,000	12,255,000	0.45 %
Total	28,714	59,710	87,924	17,431,00	0.50%

(*) Note: estimation by Telecom Advisory Services LLC based on the research-based assumptions contained in the digitization model in Katz, R., Koutroumpis, P. and Callorda, F. (2014). "Using a digitization index to measure economic and social impact of digital agendas", *Inf*o, January. In the case of Jordan, the authors believe this to be a low estimate given that the country counts 3,600 points of sale of SIM cards and 25,000 points to refill cards.
Sources: International Telecommunications Union; Telecommunications operators; GSMA Intelligence; Telecom Advisory Services analysis

Furthermore, beyond their direct economic contribution, the telecommunications industries' spillover effects have positively impacted the economy in all three countries. Thus, the telecommunications industry indirectly contributes appropriately 2.00 % of the GDP of the three countries (see table C).

Table C. MENA Countries: Indirect contribution of mobile telecommunications and fixed broadband to the economy (2014)

	Indirect Contribution (USD '000'000)		Total	GDP (USD '000'000)	Percent of GDP
	Mobile Telecommunications (*)	Fixed Broadband			
Jordan	$ 375	$ 401	$776	$ 35,765	2.17 %
Tunisia	$ 524	$ 225	$ 749	$ 48,533	1.54 %
Morocco	$ 1,597	$ 750	$ 2,347	$ 109,201	2.15 %
Total	2,496	$ 1,376	$ 3,872	$ 193,499	2.00 %

(*) It should be mentioned that the mobile broadband impact is also included in the contribution of mobile telecommunications.
Sources: Telecom Advisory Services analysis

The combination of direct and indirect effects yields a total contribution of 5.69 % of the GDP (see table D).

Table D. MENA Countries: Telecommunications Direct and Indirect Contribution to GDP (in US$ millions unless indicated)

	Jordan	Tunisia	Morocco	Total
National GDP (2012)	US$ 35,765	US$ 48,533	US$ 109,201	US$ 193,499
Direct Telecommunications Impact	US$ 1,523	US$ 1,545	US$ 4,072	US$ 7,140
Indirect Telecommunications Impact	US$ 776	US$ 749	US$ 2,347	US$ 3,872
Total Telecommunications Impact	US$ 2,299	US$ 2,294	US$ 6,419	US$ 11,012
Percent of National GDP	6.43 %	4.72 %	5.88%	5.69 %

Source: TAS analysis

The strong contribution of telecommunications to the economies of the three countries studied is a function of two factors:

- <u>The sector dynamism</u>: the telecommunications sector is growing, generating in turn direct and indirect jobs. In fact, telecommunications operators trigger the emergence of a significant number of local suppliers, distributions agents, and providers of various services, which enhance the local value added to the economy.
- <u>The positive externalities</u> ("Spill-over effects"): telecommunications networks and services result in a more efficient functioning of the economy particularly in terms of:
  - o Productivity gains in existing sectors (such as tourism, exports, manufacturing) as well as social services, such as education and public administration;
  - o Innovation incentives, leading to the creation of new businesses in the digital economy (applications, software platforms, local content);
  - o Integration of isolated regions, leading to further development of economic activities;
  - o Better coordination among economic agents through improved knowledge of inputs market prices (agriculture), resulting in lower transaction costs among industries' value chain firms, enhanced ability to negotiate selling prices, inventory management and delivery tracking;
  - o Improvement and extension of domestic economic exchanges, both at the regional and global scale.

Given the economic importance of telecommunications, public policies and regulatory frameworks need to be defined in order to maximize investment in network deployment and modernization, particularly in mobile broadband. Policies should focus on two dimensions. First, the current level of competition resulting from the industry structure is sufficient to generate enough static and dynamic welfare benefits, as witnessed by price reductions and intensive product innovation. Along these lines, the government should not consider policy remedies oriented towards increasing the number of industry players. Second, current tax burden imposed on the telecommunications sector contributes directly and significantly to the total cost of mobile ownership for Jordanian consumers and creates barriers to affordability. Research has shown that a reduction in taxation has a positive impact on technology adoption, which in turn maximizes telecommunications economic impact compensating significantly for the foregone short-term revenues to the National Treasury.

1. Introduction

The relationship between information and communication technologies (ICT) and economic development has long interested social scientists and policy makers alike. Since the mid-1970s, development banks, foundations, and academics have worked not only to understand, but also to measure quantitatively ICT's economic contribution, focusing on such areas as GDP growth, job creation, and productivity.

Through these investigations, research has relied on the study of cross-sectional samples of countries, typically limiting the scope to data-rich OECD countries or worldwide analysis due to data availability restrictions. This methodology admittedly offered a great deal of knowledge to the field and current work continues to employ this approach. That said, enabled by improved data availability, research has started to extend its reach, shifting from a global view to hone in on more country-specific data and findings. As an example, to understand broadband's economic impact, the authors have conducted studies for Germany (Katz et al., 2010), the United States (Katz and Suter, 2009; Katz et al, 2011), Costa Rica (Katz, 2011b), Chile (Katz, 2012), Colombia (Katz et al., 2011c), Philippines (Katz et al, 2012), Ecuador (Katz et al., 2013), and Francophone Africa (Katz et al., 2013).

The following study analyzes the impact of wireless and broadband communications on the economies of three Middle East and North Africa (MENA) countries: Jordan, Morocco, and Tunisia. Timing, existing adoption conditions, and market maturity all determine ICT's economic effect. As supported by multiple studies (Hardy, 1980; Jorgenson et al., 2006; Karner and Onyeji, 2007), the introduction of a new technology does not immediately produce significant economic effects. In this context, a comparison of three country-specific studies provides a perspective of the relationship between timing of technology adoption and economic effects. By the end of 2014 mobile telecommunications used by the majority of the MENA population (Jordan: 127% penetration; Morocco: 131%; Tunisia: 142%)[3], reflect a mature market that has demonstrably affected the economies of all three countries. To measure this impact, this study employs a structural model that depends on four equations modelling the market operation between 2001 and 2014 taking into account:

- Endogenous growth from existing capital and labor together with the telecommunications infrastructure metrics;
- Demand for telecommunications services depending on the price and adoption patterns;
- Supply and competition of telecommunications taking into account the regulatory and infrastructural investments in telecommunications; and
- Revenues and outputs of the telecommunications market as a proxy for the 'health' and sustainability of the market.

To offer a context for its approach, this study first provides a brief literature review of research conducted to assess the economic impact of telecommunications, introducing the

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[3] Source: GSMA Intelligence.

recent empirical literature regarding the contribution of mobile broadband (chapter 2). An overview of the MENA countries' economy follows (chapter 3) and is complemented by an explanation of the key characteristics of the countries' telecommunications market (chapter 4). Telecommunications' direct and indirect economic contributions to the countries' economy follow (chapter 5), along with a discussion of the study's methodology and findings. The policy implications derived from these findings conclude the study (chapter 6).

2. Impact of Mobile Telephony and Broadband on the economy: a review of the literature

Whether driving innovation in more advanced economies or addressing the lack of traditional fixed-line services in emerging countries, mobile phones affect all economies regardless of their stage of development. As mobile infrastructure becomes permanent, so, too, does its effect on the market and the economy. A review of the literature indicates that mobile telecommunications and broadband access can lead to more informed markets, increased employment opportunities, and GDP growth.

Multiple micro-economic studies from emerging countries show that enhanced communication results in more efficient markets, ultimately improving consumer welfare. For instance, in Kerala (India), the introduction of mobile telephony led to a more informed and demand-driven fishery market (Jensen, 2007). Similarly, in Niger, input prices in the grain market fell, resulting in increased profits for farmers and, ultimately, consumer welfare improvements (Aker, 2008). Similarly, rural Ugandan banana farmers producing perishable crops benefitted as the costs of crop marketing decreased as a result of enhanced mobile coverage (Muto, 2008).

Mobile networks can also address lack of access to traditional services. In Kenya and Tanzania, the launch of financial services and micropayments via mobile phones reduced both the cost of banking services and the transactional burdens, leading to a reduction of the countries' "unbanked" population. Similarly, the introduction of m-Health mobile applications in such countries as Ghana and Cape Verde resulted in more accessible, affordable, and higher quality healthcare services in developing countries (Kelly and Minges, 2012).[4]

In some instances, the introduction of mobile networks can lead to the development of new markets and services. When a particular region of South Africa benefitted from enhanced wireless network, employment significantly increased (Klonner and Nolen, 2010); in Malawi, female labor participation increased (Batziillis et al., 2010). On a related note, the mobile applications that assist with the job search and application process are particularly beneficial in instances of low digital literacy or where the employment process is largely informal (Donner, Gitau, and Marsden, 2011). In many cases, the higher-quality jobs are

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[4] Kelly, Tim, and Michael Minges (eds.) (2012). *Maximizing Mobile*. The World Bank. Web. <http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/IC4D-2012-Report.pdf>.

listed online, where only those citizens with digital literacy skills and Internet access can apply for them.

Additionally, it is important to note that multiple studies (see Waverman, Meschi and Fuss, 2005; Shiu and Lam, 2008; Kathuria, Uppal and Mamta, 2009; Andrianaivo and Kpodra, 2011) find initial increasing returns to economic growth as a result of the "return to scale effect" when it comes to mobile telecommunications' effects on the economy. In other words, wireless telecommunications' economic impact is maximized once the infrastructure reaches a critical mass point. As Gruber and Koutroumpis (2011) show, mobile telephony's effects on GDP growth correlate with wireless penetration growth up until penetration rates reach 60%, at which point effects tend to subside.

Like mobile networks, broadband can also affect economic growth. Through the introduction of new services and applications, new forms of commerce, mass customization of products, reduction of excess inventories and optimization of supply chains, growth in business revenue (Varian et al., 2002; Gillett et al., 2006), and growth in service industries (Crandall et al., 2007), broadband can positively impact output and employment.

While many studies that examine the relationship between fixed broadband access and the economy focus on data from the United States, additional research has recently emerged confirming positive effects of fixed broadband penetration on GDP growth in Germany (Katz et al., 2010a) as well as in Brazil, Chile, India, Saudi Arabia, Indonesia, and the Dominican Republic (Katz, 2011), Senegal (Katz et al., 2013), and Ecuador (Katz et al, 2013). On the other hand, while all of these countries witnessed a significant employment increase resulting from fixed broadband diffusion, the contribution to economic growth varied widely. Explanations for the variance could include migratory trends (Crandall), local effects (Gillett et al., 2006), and industry sector differences (Shideler et al, 2007). For example, the new jobs that opened as a result of broadband tended to occur in the service industries, although some studies also found a positive impact on the manufacturing sector as well (Crandall et al, 2007). Only in the case of labor intensive sectors such as the lodging and food services industry research detected a decline in employment opportunities as a result of broadband diffusion, likely due to the strong capital / labor substitution process (Thompson and Garbacz, 2008). This was also confirmed in a study of fixed broadband effects on US regional economies conducted by Katz et al. (2012).

The contribution of fixed broadband introduction on the economy also mimics the effects of infrastructure deployment. Beyond GDP growth, fixed broadband can impact infrastructure investment (Katz et al., 2009a; Katz et al, 2010a), productivity growth, and the elasticity of supply as well as household income. In the OECD countries, for instance, research has demonstrated that fixed broadband adoption led to a significant rise in per capita GDP (Czernich et al., 2009; Koutroumpis, 2009; Katz et al., 2010a). The countries with higher fixed broadband penetration rates saw higher GDP growth rates (Koutroumpis, 2009). A study of ASEAN countries also concluded that broadband deployment positively impacts GDP growth (Ng, Lye, and Lim, 2013), as did an examination of Indonesia and

Malaysia (Katz, 2012).[5] The same held true at a global level, where broadband adoption had less of an effect on economic growth in countries with lower broadband penetration rates (Katz, 2012).

In recent years, the explosive growth of mobile broadband allowed for the study of its specific economic contribution. Katz et al. (2013) estimated that, in the case of Senegal, a structured model similar to the one used in this study indicated that every 1% increase in mobile broadband penetration yielded 0.022% growth in GDP. Unfortunately, beyond the study mentioned above, no research has been generated so far that attempts to replicate to mobile broadband the econometric analysis conducted for fixed broadband. For example, an analysis conducted by Analysis Mason (2015) on the socio-economic impact of broadband in Thailand blends broadband adoption statistics to include both mobile and fixed lines. Interestingly enough, however, the study's coefficient of economic impact of broadband is fairly close to the one derived by Katz et al. (2013) for Senegal: 0.026%. Another study conducted to evaluate the economic impact of mobile broadband in Australia (ACMA, 2014) relied on survey data, where firms were asked to estimate the impact of the technology of areas such as cost reduction, and increased sales. Those responses were then aggregated to estimate the impact of mobile broadband on the Australian GDP. Finally, a study recently completed for the GSMA (Deloitte, 2015) determined that mobile voice and data communications has a direct economic contribution of 1.4% and 2.5% indirect impact on GDP.

In sum, multiple studies looking at both advanced and emerging economies conclude that mobile networks and broadband access (both fixed and mobile) have positive economic effects. Wireless access can result in a more efficient market, with benefits realized by both vendors and consumers. Wireless services can also address lack of access to other traditional services, such as banking or healthcare. These new services can even create new markets and increased employment opportunities, further spurring economic activity. Broadband access can also lead to job creation. Lastly, broadband access can also result in a rise in GDP, productivity growth, supply elasticity, and household income. While most studies tend to focus on developed economies, more recent studies offers evidence of these benefits in the case of emerging countries as well. This study will provide additional insights regarding the economic impact of telecommunications on the economy of Jordan.

3. The economies of three countries of Middle East and North Africa

The following section reviews the current state of the economies of the three countries under study. Its purpose is to provide a context to understand the extent of the impact of telecommunications.

3.1. Jordan

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[5] Katz, R. (2012). *Impact-of-Broadband-on-the-Economy: Research to date and policy issues.* Geneva: International Telecommunications Union.

With a total GDP of US$ 35.8 billion[6], Jordan's economy is one of the smallest in the Middle East, depicting still some persistent income distribution imbalances. Out of Jordan's total population of 7,930,491, 14.2% are below the poverty line[7] and 17.3% live in rural areas[8]. However, since 2010 GDP per capita has risen from US$ 4,370.7 to US$ 5,213.4 in 2013. This increase can be attributed, in part, to the economic reforms implemented in 1999, which included opening a trade regime, privatizing state-owned companies, and eliminating fuel subsides.[9] These reforms had a signficant impact on attracting foreign investment and increasing job creation. As a result, the unemployment rate dropped from 12.6% in 2012 to 11.9% in 2014.

In 2014, the UN ranked Jordan 77 out of 187 countries measured in the Human Development Index, a metric that takes such factors as health, income, and education dimensions into account.[10] The report classifies Jordan as "high human development" with, according to the World Bank, an upper middle-income economy. Jordan is also classified as the 38th economically liberal country, worldwide, according to the 2015 *Index*, ranking well above the average scores in the MENA region.[11] Furthermore, Jordan ranks 64th on the World Economic Forum Global Competitiveness Score, being included in the top 10 countries in the MENA region.[12] On the other hand, Jordan, has very limited natural resources and faces numerous risks including continued disruptions of gas flows from Egypt and the escalation of the Syrian conflict extending into Iraq, which causes an influx in refugees into the country. These potential threats have triggered a weakness in confidence from foreign investors. As a result, Foreign Direct Investment has decreased from 6.2% in 2010 to 5.3% in 2013.

In 2015, Jordan saw an estimated 3.4% of GDP growth in the economy, with a projected growth of 3.9% for 2016 (see table 1)[13].

Table 1. Jordan: Economic Growth

	2011	2012	2013	2014	2015	2016
Annual % Change GDP at Market Prices ($2005)	2.6	2.7	2.8	3.0	3.4	3.9
Current Account Balance / GDP (%)	-10.2	-15.2	-10.0	-11.3	-9.4	-7.9

Source: World Bank Global Economic Prospects (January 2015)

As one of the most open economies in the Middle East, this boost can be partly attributed to tourism receipts, remittances, FDI (Foreign Direct Investment) flow, and external grants.[14] However, the country still relies heavily on imports of hydrocarbon products and grains,

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[6] Source: International Monetary Fund, *World Economic Outlook Database*, April 2015

[7] 13% of the population lives on less than US$3 a day.

[8] CIA Factbook, <https://www.cia.gov/library/publications/the-world-factbook/geos/print/country/countrypdf_jo.pdf>.

[9] Jordan's Economy Profile 2014. < http://www.indexmundi.com/jordan/economy_profile.html>.

[10] United Nations. <http://hdr.undp.org/sites/default/files/hdr14-report-en-1.pdf>.

[11] Heritage Foundation http://www.heritage.org/index/country/jordan

[12] WEF Global Competitiveness Report 2014-2015.

[13] International Monetary Fund (IMF) World Economic Outlook (WEO) database, Oct 2014.

[14] *Arab Countries in Transition*, IMF. Oct 9, 2014, pg. 11.

which triggered increased economic disruption during the 2011 oil crisis in Egypt. Nevertheless, the global recession did not affect Jordan's economy as much as its neighboring Gulf countries. GDP growth fell from 7.2% in 2008 to 5.5% in 2009 and then 2.3% in 2010. This trend seems to be reversing and low positive growth has taken place since 2011 and projected through 2016. Growth was mainly attributed to a narrower trade deficit (12.8% in 2014) and increased public investments (23.8% in 2014).[15] On the demand side, public investment increased due to the higher capital expenditures financed mainly by Gulf Cooperation Council (GCC) grants. Overall, Jordan's 2014 growth performance outperformed the average 1.2% rate in the MENA region.[16] As a result of liberalization measures, the growth in GDP has occurred simultaneously with a decline of inflation (from 19.9% in 2008 to 2.8% in 2009). The slowdown in food prices caused headline inflation to moderate. While there have been slight fluctuations in the level of inflation at the end of 2014, inflation is expected to decline 2.7% from the 2013 level of 5.5%.[17]

Imports of goods and services as percent of the GDP has experienced a slow decrease throughout the years; 87.5% in 2008 to 69.21% in 2014. Exports as a percent of the GDP have remained relatively constant with a very slight decrease in 2013 and a rebound in 2014. Although there was slow credit growth of 6.3% in 2014, the Central Bank of Jordan (CBJ) decided to reduce the financial/banking policy rate in June to 2.75% while net international reserves continued to over perform[18].High-energy imports due to the 2011 oil disruption in Egypt and a rise in domestic imports driven by the increase use of mineral and chemical fertilizers triggered a widening of trade in goods balance deficits. The disruption caused Jordan to compensate by importing more expensive fuel oil and diesel.

Backed by Parliament, political reform of the country has begun and the government initiated a national restructuring program to address domestic and external impediments to growth. The implementation of the reforms such as fiscal consolidation, tax reform, administration improvements, public financial management, and energy sector reforms have been critical to maintain the fiscal internal and external balances. Overall, deficits have narrowed in 2014 due to the expanding economy and continued efforts of fiscal consolidation. There has also been a noticed improvement in revenue collection and contained growth in spending attributed to the decrease in deficits. Despite the financing of large utility companies, the government's central debt improved from 11.4% to 9.2% of the GDP from 2013 to 2014. These numbers include aid from primarily US and Gulf Cooperation Council (GCC) grants.[19]

In the short term, Jordan's economic growth is expected to increase to 3.9% due to strong private consumption as well as lower oil prices and investment projects; however this could change given the continued regional instability geopolitical threat to national

[15] *Jordan Economic Monitor: Persisting Forward Despite Challenges*, World Bank. Spring *2015,* pg. 6.
[16] World Bank. *http://www.worldbank.org/en/publication/global-economic-prospects/regional-outlooks/mena*
[17] World Bank. http://data.worldbank.org/indicator/FP.CPI.TOTL.ZG/countries/JO?display=graph
[18] *Arab Countries in Transition*, IMF. Oct 9, 2014, pg. 11.
[19] World Bank (2015). *Jordan Economic Monitor*, spring, pg. 8.

security and the international oil prices.[20] Weaknesses in inclusive growth (low scores on business climate indicators, high unemployment levels, low female participation) is being addressed by the government with the passage of several laws to improve the business climate and the formation of the National Employment Strategy (NES)[21]. Diversifying the energy supply by adopting natural gas, nuclear power, and oil shade, enacting growth enhancing reforms, and improving economic policies may help reduce deficits.[22] Improved competitiveness and increased private investment in the service sector may also help reduce employment and poverty levels in Jordan by creating a demand for jobs, especially for skilled and educated workers.

3.2. Tunisia

As the northernmost country in Africa, Tunisia exhibits a diverse export-oriented economy. The country's key exports include textiles, food and petroleum products, chemicals, and phosphates, most of which are exported to the European Union.[23] With a total population of 10,937,521, 17.2% are unemployed and 33% live in rural areas.[24] Also, 15.5% of the population is recorded to live below the poverty level.[25] The GDP per capita in current US dollars showed a slight rise (2.8%) from US$ 4,197.5 in 2012 to US$ 4,316.7 in 2013.[26] This positive growth as well as an improvement in living standards can be attributed to the current government's liberal strategy regarding investments in infrastructure and education. In 2014, Tunisia was classified as "high human development" according to the UN Human Development Index (which takes into account health, income, and education factors) and was ranked 90 out of 187 countries.[27] Furthermore, the country ranked 83 out of 148 countries on the global competitiveness scale according to the World Economic Forum.[28] In terms of the telecommunications sector, Tunisia ranked top in the E-government Development Index in Africa and 75th globally in 2014. Additionally, the WEF Network Readiness Score for Tunisia was 81 out of 143 countries.[29]

Pre-2011, Tunisia faced high unemployment rates and food prices, and widespread poverty coupled with low economic performance. Corruption and cronyism during President Zine el Abidine Ben Ali's rule (1987-2011) discouraged market liberalization, which further exacerbated the economic situation. Culminating with the event known as the beginning of the Arab Spring, Ben Ali's rule was overthrown and a technocratic government was temporarily set in place. Due to the political instability of the country, a dramatic decline in tourism and investments took place in 2011. In 2012, the new interim government focused

[20] IMF (2014). *Arab Countries in Transition*, Oct 9, page 11.
[21] IMF (2014). *Arab Countries in Transition*, Oct 9, page 12.
[22] *IMF Working Paper: New Energy Sources for Jordan: Macroeconomic Impact and Policy Considerations* 2015
[23] Tunisia Economy Profile 2014 <http://www.indexmundi.com/tunisia/economy_profile.html>.
[24] CIA World Fact book. < https://www.cia.gov/library/publications/the-world-factbook/geos/print/country/countrypdf_ts.pdf>.
[25] World Bank Data. < http://data.worldbank.org/country/tunisia>.
[26] *Ibid.*
[27] UN Human Development Index. <http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/TUN.pdf>.
[28] *Global Competitiveness Report 2013-2014.* World Economic Forum.
[29] WEF Network Readiness Index 2014.

on political issues and administrative reforms. With the elections in 2014 marking the end to the political transition, there is a renewed hope resulting from the reduced political uncertainty that has bolstered the economy and thus strengthen investor confidence.

Due to the dependence of the dinar to euro exchange rate, the Tunisian economy is vulnerable to high commodity prices. Furthermore, Tunisia faces numerous risks to its economy, primarily security instability due the crisis in Libya that is causing a decrease in tourism and influx of refugees. Other risks include social unrest around elections possibly resulting in strikes and the current political environment that causes a threat to weaken the economic policies and reforms. Additionally, slow growth in emerging markets may impact Tunisia's economy. High unemployment, regional disparities, low female labor force participation, and political instability are challenges to inclusive growth.[30]

Table 2: Tunisia: Economic Growth (2010-2015)

	2010	2011	2012	2013	2014	2015
Annual % Change GDP at Market Prices ($2005)	3.2	-0.5	4.7	2.5	2.3	2.7
Current Account Balance / GDP (%)	-4.7	-7.4	-8.2	-8.4	-9.1	-8.6

Source: World Bank Global Economic Prospects (January 2015)

Together, the industry (31.2%) and service (59.4%) sectors account for approximately 91% of Tunisia's gross domestic product (GDP).[31] Although agriculture only contributes to 9.4% of the GDP, the sector plays an important role in Tunisia's foreign trade, especially from olive oil production. The Arab Spring in 2011 caused an immediate decrease in GDP growth, falling from 3.2% in 2010 to -0.5% in 2011. The global recession also caused a decrease in growth between 2008-2011; however, this was not as extreme as the impact of the Arab Spring had on the economy. In 2012, the trend reversed itself and there was a boost in growth reaching 4.7%. Despite a diversified economy, there was a growth decline of 2.5% in 2013 due to political and social instability, euro stagnation, and a 3.3% reduction in agriculture production.[32] Slightly declining from the prior year, Tunisia saw an estimated 2.3% GDP growth in 2014, with upward economic projections into 2016. This boost can partly be attributed to service demand in the public sector. As seen by figure 1, there has been a slight increase in GDP growth; this can be primarily accredited to resilience in the tourism sector and export industries.

The population growth has increased by 1.11% over the last 10 years and according to the United Nations Economic and Social Commission for Western Africa the population is expected to increase into 2050, reaching approximately 13.2 million people.[33] 4.5% of the population lives on less that $2 USD a day. Unemployment rates dropped from 16.7% in 2013 to 15.2% in 2014.[34] In comparison with the world average, unemployment rates are

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[30] *Arab Countries in Transition*, IMF. Oct 9, 2014, pg. 17.

[31] *Tunisia* 2014, African Economic Outlook, pg. 3.

[32] *Tunisia Economic Outlook*. African Development Bank Group. < http://www.afdb.org/en/countries/north-africa/tunisia/tunisia-economic-outlook/>.

[33] *The Demographic Profile of Tunisia*, United Nations Economic and Social Commission for Western Africa. <http://www.escwa.un.org/popin/members/tunisia.pdf>.

[34] Trading Economics. <http://www.tradingeconomics.com/tunisia/unemployment-rate>.

particularly high with youth and females. As expected, there is a big disparity between the distribution of wealth between rural areas and cities causing unbalanced job distribution.[35]

Inflation rates showed periods of decline and rise throughout 2008 to 2013. The level dropped from 5.8% in 2008 to 2.5% in 2009. After rising to 5.0% in 2010 and falling in 2011 to 2.2% there has been a steady increase in inflation rates, explained to a large degree by the unstable social and political situation after the Arab Spring.

Imports of goods and services as a percent of Tunisian GDP have remained stable with slight volatility. There was a recorded fall during the recession from 59.0% in 2008 to 49.0% in 2009. Tunisia spends approximately US $24,950 billion on importing textiles, machinery and equipment, hydrocarbons, chemicals, and food related goods. Exports as a percent of GDP have shown similar patterns with slightly lower percentage points (see Figure 3). France, Italy, and Germany are the main importer/exporters to Tunisia, culminating to approximately 50%.[36] There has been a continual decline in Foreign Direct Investments (FDI) since 2008. In 2013, there was a recorded $1,096 million of FDI inflows.[37]

Differing from neighboring countries, Tunisia is currently entering an improved economic stability zone. The current account deficit reduced from -8.3% in 2013 to an estimated -7.9% in 2014.[38] Recovery in the Eurozone economy, phosphate exports, rise in tourism, and lower international commodity prices account for the decrease. However, the trade deficit widened 36% from US $1.532 billion in 2013 to $2.083 billion in 2014.[39] The gap in trade was predominately noticed in agriculture, manufacturing, agro-food industries, and engineering industries. Although exhibiting a slightly lower-than-average percentage for the North African region, the trade deficit is projected to improve from -7.7% to -6.6% in 2015. According to the International Monetary Fund, the budget deficit will improve, approaching -6% in 2015. In regards to external trade balances, there is an improvement in exports, tourism, and foreign direct investment (FDI). An increase in foreign financing and recovery in FDI will assist in reducing the current deficit.

To reduce external and fiscal deficit, the implementation of a tight monetary policy with wage freezes, greater exchange rate flexibility, and reduced exemptions and subsides will help. To address the challenges listed above regarding inclusive growth, the government is focusing on creating a competitive business climate, strengthening public tax policy and administration reforms like transparency, and improving the governance of public enterprises.[40] The Central Bank of Tunisia (CBT) continues a 2012 policy of neutral intervention strategy and raised the interest rate from 4% in 2012 to 4.5% in 2013.[41] The

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[35] The Economist. < http://www.economist.com/node/17862305>.

[36] Global Finance. <https://www.gfmag.com/global-data/country-data/tunisia-gdp-country-report>.

[37] United Nations Conference on Trade and Development: World Investment Report 2014.

[38] *IMF Country Report: Tunisia*. IMF, page 7.

[39] Al-Monitor. <http://www.al-monitor.com/pulse/business/2014/04/tunisia-economy-trade-deficit-risks.html#>.

[40] *Arab Countries in Transition*, IMF. Oct 9, 2014, pg. 18.

[41] *Tunisia* 2014, African Economic Outlook, pg. 5.

market rate at current level failed to improve due to low pressure on the exchange rate, weak credit growth, negative output gap, and level core inflation.[42] However, if there is a rapid rise in inflation or depreciation pressures rise then the CBT plans to further tighten monetary policies.

Since the economic situation has deteriorated from 2011, the budget bill of 2013 was revised since GDP growth was below the projected 4.5%. This can be attributed to the depreciation of the dinar, increases in energy subsidy expenses, and a drop in tax revenues. The revised 2013 budget called for a 50% cut in subsidies for industrial consumers of electricity and gas, smaller tax revenue, and 36% revenue fee drop from Tunisian section of the Algerian/Italian gas pipeline that passes through the country.[43] Continuing these reforms, the 2014 Budget Act included a cut in corporate tax rates by 5% and taxing dividends at a 5% rate with the aim at creating a uniform 20% tax rate.[44] With these reforms, the government hopes to see a rise in private employment, reduce external vulnerabilities, and improve price competitiveness leading to creating an overall success in Tunisia's ongoing transition to a productive market economy.

3.3. Morocco

Morocco's diverse market-oriented economy benefits in part from the country's proximity to Europe combined with low labor costs. At US$ 109 billion, the Moroccan economy is projected to grow at 4% in the near future (see table 3).

Table 3. Morocco: Economic Growth (2011-2016)

	2011	2012	2013	2014	2015	2016
Annual % Change GDP at Market Prices ($2005)	5	2.7	4.4	3	4.6	4
Current Account Balance / GDP (%)	-8	-9.7	-7.6	-5.9	-4.2	-3.6

Source: World Bank Global Economic Prospects (January 2015)

The global recession of 2008 negatively affected Morocco's economy. GDP growth fell 14% from 5.6% in 2008 to 4.8% in 2009, and an additional 18% to 2.6% in 2010. In 2011, the decline reversed and there was a boost of 92% in growth reaching 5.0% due to the new government's commitment to economic reform. The 4.8% decline in GDP per capita from $3,044.11 in 2011 to $2,899.97 in 2012 was due to internal economic difficulties such as the poor harvest. In 2013, the economy rebound, with GDP per capita reaching $3,092.61 in 2013.[45] This positive growth can be attributed to a multitude of reforms initiated by the government including industrial development strategies and infrastructure improvements (the new port and free-trade zone near Tangiers).[46] The GDP deceleration from 2013 to 2014 was due to a decline in the agriculture sector resulting from insufficient rainfall,

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[42] *Country Report – Tunisia*, IMF. April 2014, pg. 11-12.
[43] *Tunisia* 2014, African Economic Outlook, pg. 5.
[44] *Ibid.*
[45] World Bank Data. <http://data.worldbank.org/country/morocco>.
[46] Morocco Economy Profile 2014. <http://www.indexmundi.com/morocco/economy_profile.html>.

coupled with overall slow economic growth in Europe.[47] However, growth is projected to accelerate into 2015 as external demand rises due to increased European GDP growth, combined with strong performance in newer industries.[48] Since 2013, Morocco's economic growth appears to be tracking that of the MENA region. Combined, the industry (24.9%) and service (61.1%) sectors account for 86% of Morocco's gross domestic product (GDP).[49] Although agriculture only contributes to approximately 15% of the GDP, this sector employs 45% of the labor force.

Inflation declined rapidly from 5.9% in 2008 to 1.5% in 2009 due to a cautious monetary policy. It has remained within the 1% range since then. The falling trend continued reaching 0.1% in 2011 paralleling the decline in international commodity prices. Although there has been a slight increase in inflation in recent years caused by a rise in food prices and a decrease in subsidy on fuels, the IMF projects the rate to remain at a low 1% for the country.[50] The Central Bank of Morocco (CBM) supports this low inflation with a current subsidiary system that includes reduced budgetary costs and macro-economic management.[51]

Imports of goods and services as a percent of GDP have remained stable with slight volatility. During the global recession, there was a recorded fall from 50.9% in 2008 to 39.7% in 2009. Morocco's main imports include petroleum, textile fabric, telecommunication equipment, wheat, gas, electricity, transistors, and plastics.[52] Exports as a percent of GDP show similar patterns with slightly lower percentage points also as a result of the global recession in 2008-2009.

Spain (19.2%) and France (17.6%) are the primary exporters to Morocco causing dependence on the euro to dirham exchange rate. According to the 2015 Index of Economic Freedom, there was a recorded $3.4 billion Foreign Direct Inflow (FDI).[53]

The current account deficit reduced from -10.0% in 2013 to -7.6% in 2014.[54] This reduction, coupled with increased foreign exchange reserves can be attributed to economic reform policies, upcoming export sectors, and a decline in international oil prices. In November 2014, a new Organic Budget Law and a new banking law were passed to help broaden the regulatory role of the CBM. The Organic Budget Law is aimed to improve the government's budget design and implement an enhanced public service delivery.[55] Despite these successful measures, inequalities in income, gender, and regional disparities are present. Since the recession, Morocco has accepted two IMF Precautionary and Liquidity

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[47] World Bank. <http://www.worldbank.org/en/country/morocco/overview>.

[48] *Arab Countries in Transition*, IMF. Oct 9, 2014, pg. 15-16.

[49] CIA Fact book

[50] *Arab Countries in Transition*, IMF. Oct 9, 2014, pg. 16.

[51] Euler Hermes. <http://www.eulerhermes.com/economic-research/country-reports/Pages/Morocco.aspx>.

[52] *Ibid.*

[53] Heritage Foundation.

[54] http://www.tradingeconomics.com/morocco/current-account-to-gdp

[55] Heritage Foundation.

Lines, one in 2012 and the other in 2014. However, the country has not used these funds and secured them only as a precautionary measure.[56] Morocco places a restriction on the purchase of agricultural land and investments in certain sectors for foreign investors causing a strain regarding the openness of their markets. Improvement in internal and external balances has led to the previously noted current account deficit decrease in addition to an overall shrinking of the budget deficit in 2011 to 4.9% of the GDP.[57] In 2012, the fiscal deficit reached 5.3% of the GDP prompting the government to implement measures to improve revenue collections.[58] In 2015, the government passed a budget law addressing reforms in the tax and pension system.

Despite unrest in the neighboring areas and Arab Spring protests, Morocco's economy has mainly remained largely unaffected. Nevertheless, countering recent economic prosperity, concerns regarding unemployment, poverty, and illiteracy rates remain high. With a total population of 32,987,206, 15% live below the poverty line.[59] Also, 43.3% of the population lives in rural areas of the country.[60] Unemployment rates increased from 8.8% in 2013 to 9.3% in 2014 with youth employment remaining relatively high.[61]

Morocco also faces additional risks to its economy: potentially slow growth in trading partners especially in Europe, geopolitical instability impacting oil prices, and a "surge in global financial market volatility."[62] Other internal challenges impacting the economy include fighting corruption and the lack of reform in the educational system, judiciary branch, and the government's subsidies program.

To address some of these issues, the Moroccan government continues to implement reform programs. Subsides, taxation, retirement, social protection, and the fiscal system are focused to improve the efficiency of public finances and support the development of inclusive growth.[63] With reduced public investment in 2014, the fiscal deficit is projected to decrease to 3% of the GDP by 2016.

In 2014, Morocco scored 129 out of 187 in the UN Human Development Index placing it in the "high human development" category. As reported by 2015 Index of Economic Freedom, Morocco scored 60.1, categorizing the nation as "moderately free," a score that is just below the world average of 60.4.[64] Furthermore, the country ranked average with 77 out of 148 countries on the global competitiveness score.[65] In terms of the telecommunications sector,

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[56] *Moroccan Economy on the Right Track.*
<http://www.imf.org/external/pubs/ft/survey/so/2015/CAR022315A.html>.
[57] Heritage Foundation.
[58] Morocco Economic Outlook. <http://www.afdb.org/en/countries/north-africa/morocco/morocco-economic-outlook/>.
[59] CIA Fact book <https://www.cia.gov/library/publications/the-world-factbook/geos/mo.html>.
[60] Rural Poverty Portal. <http://www.ruralpovertyportal.org/en/country/statistics/tags/morocco>.
[61] Trading Economics. <http://www.tradingeconomics.com/morocco/unemployment-rate>.
[62] *Arab Countries in Transition*, IMF. Oct 9, 2014, pg. 16.
[63] *Ibid.*
[64] 2015 Index of Economic Freedom. Heritage Foundation
[65] WEF Global Competitiveness Report 2013-2014.

in 2014 Morocco ranked 82th globally in the E-government Development Index and the WEF Network Readiness Score was 78 out of 143 countries.[66]

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In the context of the three country economic conditions, and based on the experience in the emerging world, telecommunications infrastructure can play an important role. On the economic side, telecommunications can:

- Increase the inter-linkages among national enterprises;
- Facilitate exports;
- Improve productivity of small farmers by enhancing their access to inputs while facilitating market reach;
- Serve as an underlying network that would foster financial inclusion of a population marginalized from banking services; and
- Deliver training resources, thereby supplementing the pre-existing educational system.

From a social standpoint, both wireless telephony and broadband should improve social inclusion of rural populations and enhance welfare of the urban poor. Let's now turn to assessing the state of development of the respective telecommunications industries.

3. The Telecommunications Industry in the MENA countries

4.1. Telecommunications demand

The demand for telecommunications services in all three MENA countries under study grew rapidly over the last ten years, primarily driven by the adoption of mobile telephony. For example, driven by proactive government policies, the telecommunications sector in Jordan has exhibited rapid growth with continuous expansion over the years. In the past ten years, the number of mobile subscriptions in the country has increased significantly; up from 3,035,000 subscribers in 2005 to 10,213,000 in 2015 exhibiting over 12.90 % CAGR[67]. Similarly, driven by strong demand and competitive intensity, the Tunisian telecommunications sector has exhibited rapid growth. Mobile connections experienced an annual increase of 11.68 % from 2005 to 2015 and are expected to increase further due to the deployment of LTE/4G services. Overall, mobile connections have increased from 5,442,000 in 2005 to 16,428,000 in 2015. In addition, mobile connections in Morocco experienced a steady increase of 13.25% from 2005 to 2015. Overall, mobile connections in Morocco have increased from 12,956,000 in 2005 to 44,960,000 in 2015. Table 4 compiles the penetration and aggregate subscribership of mobile telephony for all three countries between 2004 and 2015.

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[66] WEF Network Readiness Index 2014.
[67] Source: GSMA Intelligence (2015).

Table 4. MENA countries: Mobile Telephony Penetration (in percentage of population) (2004-2015)

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015[68]
Jordan	Subscribers ('000)	1,604	3,035	3,976	4,405	5,425	6,113	6,666	7,771	9,056	9,895	9,686	10,213
	Penetration	31 %	57 %	72 %	76 %	90 %	97 %	101 %	113 %	127 %	134 %	127 %	133 %
Tunisia	Subscribers ('000)	3,405	5,442	7,081	7,843	8,602	9,796	11,214	12,637	13,628	13,872	15,888	16,428
	Penetration	34 %	54 %	69 %	76 %	82 %	93 %	105 %	117 %	125 %	125 %	142 %	146%
Morocco	Subscribers ('000)	9,431	12,956	16,005	20,029	22,816	25,310	31,982	36,554	39,016	42,439	44,115	44,960
	Penetration	31 %	43 %	52 %	65 %	73 %	80 %	100 %	113 %	119 %	128 %	131 %	132 %
MENA average penetration		23 %	36 %	47 %	63 %	74 %	88 %	100 %	110 %	115 %	118 %	119 %	121 %

Source: GSMA Intelligence

Tunisia's mobile penetration rate of 146% in 2015 places the country well above the average level for the MENA region (121%). While lower than Tunisia's, mobile penetration in Morocco and Jordan is still higher than the regional average.

On the other hand, wireline services are in a consistent decline in all three countries. While Jordanian wireless experienced a steady annual increase of 18.33% in subscriptions between 2004 and 2015, fixed lines have shown an annual decrease of 4.86% throughout the same period with 638,000 subscriptions in 2004 falling to 369,000 in 2015. In Morocco, while fixed-line subscriptions showed a significant boost - 177% increase - between 2006 and 2010, credited to the introduction of new market operators, they have been declining ever since. As a result, access lines fell 9.93% annually from 3,749,364 in 2010 to 2,222,000 in 2015. Finally, fixed telephony access lines in Tunisia have fallen from 1,273,332 in 2007 to 944,000 in 2015. The wireline access lines for all three countries are presented in table 5.

Table 5. MENA countries: Fixed Telephony Access Lines ('000) (2004-2015)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	CAGR
Jordan	638	628	614	559	519	501	486	465	434	378	375	369	-4.86%
Tunisia	1,204	1,257	1,268	1,273	1,239	1,279	1,290	1,218	1,099	1,022	949	944	-2.19%
Morocco	1,309	1,341	1,266	2,394	2,991	3,516	3,749	3,566	3,279	2,924	2,488	2,222	4.93%

Source: ITU World Telecommunication/ICT Indicators 2016

At this point, because of strong fixed-mobile substitution, Jordan has the lowest fixed-line penetration rate per 100 inhabitants in the Middle East at 4.80 %, significantly below the regional average of 22 %[69]. While 28 % of households in Jordan have one main telephone line, with the increasing use of mobile telephony, the government predicts the continued decline in the number of fixed-line subscriptions.

Consistent with the trend toward fixed-mobile telephony substitution, fixed broadband remains considerably underdeveloped across all three countries (see table 6).

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[68] Data for 3Q15.

[69] Embassy Of Sweden, Amman: Delegation Pre-Study – Sector Briefs, Jordan: Telecom Sector.
<http://www.swedenabroad.com/SelectImageX/30230/JordanSectorAnalysis.pdf>.

Table 6. MENA Countries: Fixed Broadband Connections ('000) (2004-2015)

		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	CAG
Jordan	Subscribers ('000)	10	24	49	89	146	238	293	297	300	328	352	320	36,53
	Penetration	1.1%	2.4%	4.7%	8.4%	13.2%	20.9%	25.2%	24.9%	24.7%	26.0%	27.0%	24.0%	32.32
Tunisia	Subscribers ('000)	3	18	44	96	227	373	510	559	527	520	499	488	59.66
	Penetration	0.1%	0.8%	1.9%	2.9%	6.8%	11.0%	14.0%	16.1%	15.0%	14.7%	13.9%	13.5%	52.71
Morocco	Subscribers ('000)	65	249	392	477	493	480	504	595	690	844	993	1,148	29.88
	Penetration	1.1%	4.0%	6.2%	7.5%	7.6%	7.3%	7.6%	8.9%	10.2%	12.3%	14.3%	16.3%	27.81
MENA average penetration		3.0%	4.5%	6.3%	8.4%	11.3%	14.3%	16.4%	19.0%	21.8%	24.1%	27.4%	31.4%	23.91

Source: ITU World Telecommunication/ICT Indicators 2016

On the other hand, 3G and 4G services have played a role in driving an emerging broadband market in all three countries. 2010 marked the introduction of 3G and 4G services in Jordan. The subscription rate showed a dramatic increase in the past five years from 185,126 subscriptions in 2010 to 4,372,354 in 1Q 2015 (a CAGR over 110%)[70]. The introduction of LTE services and the increasing 3G coverage from 50% in 2010 to 90% in 2012 has contributed to the continuing rise in the subscriptions for these services.[71] In Tunisia, there is a noted exponential growth of wireless broadband subscriptions from 2011 to 2015. In 2015, there were 5,142,610 mobile broadband subscriptions whereas fixed-broadband subscribers were only 488,000. Similarly, wireless broadband subscriptions have been growing exponentially in Morocco since 2010 - 36% annual increase from 2010 to 1Q 2015 - whereas fixed broadband subscriptions only showed moderate growth (18%) for the same period. As the emphasis on the wireless sector grows, fixed broadband lines showed a slower growth, only doubling between 2010 and 2015, therefore reaching 1,148,000.

Table 7. MENA countries: Wireless Broadband Connections (2008-2015)

	2008	2009	2010	2011	2012	2013	2014	2015[72]	CAGR 2010/15
Jordan	4,602	15,053	185,126	1,620,061	2,425,762	3,378,652	4,203,995	4,372,354	110%
Tunisia	0	0	97,367	269,198	1,433,955	2,640,666	5,000,436	5,142,610	154%
Morocco	716,340	1,595,471	2,893,355	5,527,626	6,860,666	7,944,555	10,543,897	10,833,684	36%

Source: GSMA Intelligence

The consequence of the rise in wireless broadband adoption has been an increase in Internet usage across the three MENA countries under study. For example, the Internet penetration rate in Jordan in 2008 was 23%. However, with the government's Information and Communication Technology (ICT) strategy, the penetration rate increased to 86% or 5.7 million users in 2015 (274% in seven years)[73]. The majority of Internet subscriptions (4.99 million) are mobile broadband subscribers.

4.2. Telecommunications supply

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[70] Source: GSMA Intelligence (2015).

[71] *Ibid.*

[72] Data for 1Q15

[73] Source: *ITU World Telecommunication/ICT Indicators 2015 & Internet World Stats in 2015*

As market competition, mobile adoption, and mobile usage in the three MENA countries developed, so did industry revenues. Further, operators have expanded their reach with an increased focus on previously underserved segments of the population, offering less expensive services, plans, and handsets. At the same time, while these factors contributed to revenue growth, they also led to the decline in mobile ARPU that resulted in its stabilization. As mobile broadband gained momentum, however, revenues could likely follow another ascent (see table 8).

Table 8. MENA Countries: Telecommunications Industry Revenues (in US$ million)

Country	2008	2009	2010	2011	2012	2013	2014
Jordan	1,420	1,497	1,614	1,669	1,685	1,580	1,523
Tunisia	1,614	1,778	1,956	1,848	1,828	1,697	1,545
Morocco	4,190	4,208	4,255	4,612	4,137	3,915	4,072

Source: International Telecommunications Union

Total industry revenues in all three countries have remained relatively stable. This means the exponential growth in technology adoption has been driven by significant price decline, which has improved overall affordability of telecommunications.

In general terms, the competitive dynamics of the wireless telecommunications industry in the region is moderate to high. All three MENA countries under study have three wireless players, while Jordan and Tunisia have approximately six fixed broadband operators. As a consequence, the Herfindahl-Firschman index of industry concentration ranges between 3,551 and 3,406 for wireless. In the case of fixed broadband, Jordan and Tunisia exhibit moderate competition, while Morocco's fixed broadband industry is more concentrated (see table 9).

Table 9. MENA Countries: Telecommunications Industry Market Structure

Country	Market Structure Metrics	2008	2009	2010	2011	2012	2013	2014	2015
Jordan	Number of Wireless Telephony Players	5	5	5	4	4	3	3	3
	Wireless Telephony Herfindahl Hirshman Index	3,442	3,377	3,341	3,336	3,413	3,402	3,406	3,406
	Number of Fixed Broadband Players	2	2	3	3	4	5	6	- - -
	Fixed broadband Herfindahl Hirshman Index	6,628	5,748	3,828	4,156	3,960	3,778	3,683	- - -
Tunisia	Number of Wireless Telephony Players	2	2	3	3	3	3	3	3
	Wireless Telephony Herfindahl Hirshman Index	5,001	5,020	4,477	4,208	4,090	4,073	3,687	3,541
	Number of Fixed Broadband Players	- - -	- - -	- - -	- - -	- - -	- - -	7	- - -
	Fixed broadband Herfindahl Hirshman Index	2,697	3,614	3,516	3,439	4,653	4,643	4,647	- - -
Morocco	Number of Wireless Telephony Players	3	3	3	3	3	3	3	3
	Wireless Telephony Herfindahl Hirshman Index	5,224	5,036	4,108	3,687	3,576	3,470	3,433	3,445
	Number of Fixed Broadband Players	3	3	3	2	2	2	2	- - -
	Fixed broadband Herfindahl Hirshman Index	7,725	7,794	7,878	8,067	8,003	8,135	8,663	- - -

Source: GSMA Intelligence; Ovum; Country Regulators; Telecom Advisory Services analysis

The Jordanian telecommunications industry exhibits moderate competitive intensity. Beyond active competition in the mobile segment, fixed broadband depicts intermodal competition between ADSL and Wimax (see table 10).

Table 10. Jordan: Telecommunications Industry Structure (2014) (lines in '000)

	Fixed telephony		Wireless Telephony		Wireless Broadband		Fixed Broadband	
	Lines	Share	Connections	Share	Connections	Share	Subscribers	Share
Jordan Telecom Group	375	100%	3,137	32.4 %	1,592	37.8%	207	59.1%
Zain			3,849	39.7 %	2,083	49.4%	36	10.2%
Umniah (Batelco)			2,700	27.9%	537	12.7%	29	8.4%
Mada Communications							9	2.7%
Kulacom Jordan							14	3.9%
Other							55	15.7%
Total	375		9,686		4,212		350	

Sources: ITU; GSMA Intelligence; OVUM

The fixed telephony market is relatively concentrated with Jordan Telecom having a wireline monopoly but facing competition from VoIP operators. The Jordan Telecom Group, with a majority ownership by Orange (51%), offers fixed-line telephony (local, domestic long distance, international), data, Internet, mobile, and IPTV services. The group operates under four arms, Jordan Telecom (fixed line), Orange Jordan (wireless), Wanadoo (Internet, data), and e-Dimension (content, wholesale), with revenues of US$ 522 million in 2013.[74] The number of main telephone lines operated by Jordan Telecom has decreased by -25.09% between 2009 and 2014 (see Table 11).

Table 11: Jordan Telecom: Fixed Telephone Lines (2009-2014)

	2009	2010	2011	2012	2013	2014	CAGR
Main telephone lines	501,238	485,529	465,388	434,437	378,411	375,483	-5.6%

Source: ITU World Telecommunication/ICT Indicators 2015

At the end of 2014, there were 375,483 fixed lines recorded representing a 5.6% CAGR decline from 501,238 in 2009.[75] Fixed to mobile substitution is credited to be the main reason for the decline of fixed-line subscriptions.[76] In addition, the development of WiMAX technology contributed to the fixed line decline. The decrease in the number of fixed lines is negatively implicating ADSL services. Furthermore, the introduction of local loop unbundling has reduced the dependence on other operators and the introduction of naked DSL.[77]

The decline in fixed lines was mirrored by a decrease in wireless telephony subscriptions between 2013 and 2014. Zain showed a decline of 0.6% from 4,001,520 in 2013 to 3,976,235 in 2014 and Orange had a 2.9% decline from 3,323,369 in 2013 to 3,227,180 in 2014. Umniah's wireless telephony subscriptions have remained relatively stable. That said, the number of connections has been growing again in 2015 for all three operators (see Table 12).

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[74] Reuters

[75] *Ibid*., pg. 26.

[76] *Ibid.*

[77] *Ibid*.

Table 12. Jordan: Wireless Telephony Connections (2010-2015)

	2010	2011	2012	2013	2014	2015
Zain	2,530,537	2,810,072	3,567,511	4,001,520	3,976,235	4,092,580
Orange	2,167,296	2,723,903	3,232,846	3,323,369	3,227,180	3,433,749
Umniah	2,010,440	2,320,313	2,408,440	2,761,301	2,760,487	2,895,021

Source: GSMA Intelligence (2015)

As depicted in table 5, the wireless telephony market is split across three operators. However, Zain holds a larger share both in terms of subscribers and revenues (see table 13).

Table 13. Jordan: Wireless subscriber and revenue market shares (2010-2015)

	2010		2011		2012		2013		2014		
	Subscriber	Revenue	Subscriber	Revenue	Subscriber	Revenue	Subscriber	Revenue	Subscriber	Revenue	Subscribe
Zain	39.3%	50.3%	35.6%	48.2%	37.3%	49.1%	39.1%	51.8%	39.7%	45.8%	39.1%
Orange	32.3%	25.8%	33.6%	29.0%	35.4%	28.2%	34.2%	24.7%	32.4%	21.0%	32.9%
Umniah	27.6%	22.8%	30.5%	22.8%	27.1%	22.8%	26.4%	23.6%	27.9%	22.9%	27.9%

Source: GSMA Intelligence (2015)

Between 2013 and 2014, Zain recorded a 1.5% rise in subscribers and a decline in market share of revenues from 51.8% to 45.8%. In 2014, Orange held 32.4% of total connections and 21.0% of aggregated sector revenues. The company has lost share of both subscribers and revenues from 2013. The company is recorded to have 3.4 million subscribers as of November 2015. Unmiah's mobile subscription market share stands at 27.9% in 2015. The company's revenue share is reported to be 22.9% in 2014, holding the least amount of subscribers and revenue in the market compared to Orange and Zain. With market penetration at saturation rates (133%), the industry has been undergoing intense price competition, resulting in a decline in price realization. Since 2010, the blended ARPU (Average Revenue Per User) for all three players has been declining.

The Tunisian telecommunications industry exhibits high competitive intensity. Beyond active competition in the mobile segment, fixed broadband depicts service-based competition based on local loop unbundling (see table 14).

Table 14. Tunisia: Telecommunications Industry Structure (2014) (lines in '000)

	Fixed telephony		Mobile Telephony		Mobile Broadband		Fixed Broadband	
	Lines	Share	Connections	Share	Connections	Share	Subscribers	Share
Tunisie Telecom	857	90.3%	5,050	31.8%	1,056	19.5%	5	1.0%
Ooredoo (NMTC)	6	0.6%	7,523	47.3%	1,837	36.6%	21	4.3%
Orange	86	9.1%	3,314	20.9%	2,107	43.9%	87	17.5%
Globalnet							89	17.8%
Hexabyte							43	8.6%
Topnet							241	48.5%
FSI Publics							11	2.3%
Total	949		15,887		5,000		498	

Sources: ITU World Telecommunication/ICT Indicators 2015; GSMA Intelligence; Instance Nationale des Télécommunications

The recorded number of fixed telephone lines in 2014 was 949 million. Key centers for communications in Tunisia include Sfax, Sousse, Bizerte, and Tunis. Tunisie Telecom is the incumbent fixed operator in the Tunisian market. Orange Tunisie was the second fixed operator to launch in the market. Ooredoo Tunisie, the third entrant to the market, started operations in November 2013.

Tunisia is considered to be middle-low tier of fixed broadband penetration (13.91% of households in 2014) in the emerging world. As viewed in the section before, fixed broadband subscription rates have leveled off at an average of 498,515 lines. Topnet, the main operator in this sector, reported 241,000 ADSL lines by year-end 2014. Recently the unbundling of local exchanges for broadband has lead to competition in the market by Orange. The operator offers broadband services over a 400km fiber backbone. There are 11 Internet Service Providers (ISP) in Tunisia. Of these, six are government-owned (ATI, INBM, CCK, CIMSP, IRESA, and FSI) and five are privately held (Orange, Globalnet, Hexabyte, Topnet, and Tunet). The rapid development in Internet allows Tunisia to hold the highest Facebook penetration rate (31%) in Africa.[78]

As fixed line subscribers continue to decrease, mobile lines have steadily increased. With a 142% penetration rate, there are a total of 15.88 million mobile telephones, way above the 949 thousand recorded fixed lines. The competition between the different mobile service providers resulted in lower activation charges and usage charges contributing to the surge in mobile subscriptions in the past ten years. Three main companies offer mobile services: Tunisie Telecom, Ooredoo, and Orange (see table 15).

Table 15: Tunisia: Mobile telecommunications market share (2009-2015)

	2009	2010	2011	2012	2013	2014	2015
Tunisie Telecom	46.6 %	40.4 %	36.7 %	33.4 %	31.4 %	31.8 %	30.4 %
Ooredoo	53.2 %	52.9 %	52.4 %	52.7 %	53.5 %	47.3 %	44.6 %
Orange		6.7 %	10.9 %	13.8 %	15.1 %	20.9 %	24.9 %

Source: GSMA Intelligence

In 2015, Tunisie Telecom held 30.4% of the market share, while Ooredoo held 44.6% and Orange controlled 24.9% of the market. Tunisie Telecom 2G coverage is 100% of the urban population and 85% of the rural population. [79] The carrier offers SMS voice messaging and other value services. The second mobile entrant in 2002, Ooredoo, covers over 99% of the total population and also offers similar value added services. Orange, the last entrant, was the first mobile provider to offer 3G services (in May 2010). Their services include video telephony, mobile TV via WAP, and video surveillance systems.[80] Tunisie Telecom showed a slight decrease (6.0%) in subscriptions from 2013-2014. Ooredoo and Orange's subscriptions for wireless telephony also declined by 4.4% and 19.7% respectively in the same period.

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[78] "Tunisia's Telecommunication Troubles," Good Governance Africa. <http://gga.org/stories/editions/aif-16-bridge-the-gaps/tunisia2019s-telecommunications-troubles>.
[79] "Information Insights: Tunisia," Microsoft Communications and Media Sector, 14 July 2012.
[80] *Ibid.*

Tunisie Telecom and Orange entered a partnership with Interroute (UK based) to extend a fiber-optic cable from Tunisia to Sicily.[81] In February 2014, Tunisie Telecom embarked on a three year deal with the French-US vendor Alcatel-Lucent to upgrade their network; Tunisie Telecom aims to develop voice and data network into a single IP infrastructure. To upgrade the provider's broadband, ADSL/VDSL/GPON technologies will be implemented. The company introduced a rollout of 2G/3G services to the rural Saharan areas of Tunisia in May 2014.[82]

Finally, the Moroccan telecommunications industry exhibits high competitive intensity. Beyond active competition in the mobile segment, fixed broadband depicts service-based competition based on local loop unbundling (see table 16).

Table 16. Morocco: Telecommunications Industry Structure (2014) (lines in '000)

	Fixed telephony		Mobile Telephony		Mobile Broadband		Fixed Broadband	
	Lines	Share	Connections	Share	Connections	Share	Subscribers	Share
Meditel (Orange)			13,592	30.8%	2,716	25.4%		
Maroc Telecom (Etisalat)	2,488	100 %	18,230	41.3%	4,771	44.6%	983	100 %
Inwi (Wana)			12,293	27.9%	3,199	29.9%		
Total	2,488		44,115		10,688		983	

Sources: ITU; GSMA Intelligence; ANRT

Maroc Telecom had a monopoly over the fixed infrastructure network. In June 2014, ANRT established rules governing local loop unbundling (LLU) with the aim to level the fixed broadband playing field.[83] With the new regulations, Maroc Telecom is required to provide colocation, third party operators equipment, install multi-operator cabinets, and establish active wholesale offer for third-party operators under the VULA model.[84] The ANRT ordered Maroc Telecom to change the conditions of their wholesale leased line access offer in order to ensure a profit margin of 50% for other operators.[85] After ANRT posed the new regulations, Inwi and Meditel accused Maroc Telecom of failure to publish a wholesale offer for access to its fixed local loop.

Of the 46 million mobile connections market at the end of 2015, Maroc Telecom held 41.1% share while Meditel controlled 32.8% and Wana (Inwi) held the least (26.1%) (see Table 17).

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[81] <http://gga.org/stories/editions/aif-16-bridge-the-gaps/tunisia2019s-telecommunications-troubles>.
[82] TeleGeography, 23 May 2014.
[83] TeleGeography, 23 Jun 2014.
[84] *Ibid.*
[85] TeleGeography, 16 Jul 2014.

Table 17. Morocco: Mobile market shares (%) (2010-2015)

	2010	2011	2012	2013	2014	2015
Maroc Telecom (Etisalat)	52.8%	46.8%	45.8%	42.9%	41.3%	41.1%
Meditel (Orange)	33.7%	32.9%	29.5%	29.2%	30.8%	32.8%
Inwi(Wana)	13.4%	20.2%	24.7%	28.0%	27.9%	26.1%

Source: GSMA Intelligence

As the region fastest multinational telecom operator with pursuits in northwest Africa, Maroc Telecom saw an increase in both mobile and broadband subscriptions, 16,890,000 in 2010 to 18,230,000 in 2014 for mobile and 681,673 in 2012 to 983,000 in 2014 in fixed broadband[86]. The second mobile entrant in 2000, Meditel, broke the monopoly that Maroc held over the sector. Meditel offers mobile telephony, fixed broadband, and fixed-line telephony through local loop unbundling. Despite intense competition within the sector, Meditel's mobile subscriptions increased from 11,523,000 in 2012 to 13,592,000 in 2014. 94% of Meditel's customers are prepaid. The most recent mobile entrant, Inwi (Wana), offers mobile telephony, Internet, and mobile services. From 2012 to 2013, Inwi saw a surge of more than 400% in connections.

3G is the dominant Internet access mode in Morocco (accounting for 89% of the total Internet market at end-September 2014)[87]. With 5.44 million mobile broadband customers[88], Maroc Telecom leads the market by subscribers.

Table 18. Morocco: Wireless Broadband Market Shares (%) (2010-2015)

	2010	2011	2012	2013	2014	2015
Maroc Telecom (Etisalat)	39.5	36.3	34.4	32.8	44.6	49.6
Meditel (Orange)	28.9	32.7	33.6	33.0	25.4	22.0
Inwi (Wana)	31.6	29.0	32.0	34.2	29.9	28.3

Source: GSMA Intelligence 2015

During 2014, the wireless operators started trialing LTE services in preparation for a bid of LTE/4G spectrum auction, which took place in November 2014. Maroc Telecom's LTE trial proved a success in Rabat with download speeds up to 140Mbps. The carrier has upgraded its mobile network in additional locations: Tangier, Kenitra, El Jadida, and Laayoune.[89] The operator also aims to expand the coverage and quality of 3G networks as it rolls LTE infrastructure. Inwi additionally conducted LTE tests in the Mohammedia region. In March 2015, ANRT granted a 20-year LTE concession to all three of the countries mobile operators. The concession includes operation of trunked radio networks (3RP), satellite telecommunication services with GMPCS technologies, and telecom satellite services with VSAT technology.[90]

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[86] Source: ITU World Telecommunication/ICT Indicators 2015

[87] Source: ANRT

[88] Source: GSMA Intelligence 2015.

[89] TeleGeography, 14 Nov 2014.

[90] TeleGeography, 4 Mar 2014.

The ADSL sector, dominated by Maroc Telecom, decreased dramatically relative to 3G in the past year; in 2013, ADSL only represented 15% of Internet subscriptions whereas 3G represented 85%.[91] As part of the Moroccan government's 10 year national Broadband Plan, fixed-line infrastructure is being upgraded. The aim of this plan is to provide fixed and mobile broadband access to the entire population by 2022. 49% of the population recorded using the Internet in 2010 with a 3G handset penetration of 17.21% in 2011 with figures expected to grow.[92] Maroc, Meditel, and Inwi are the main Internet Service Providers in the country.

The ANRT gained the power to impose penalties up to 20% of company turnover (pre-tax) in infringement cases through legislative amendments.[93] Additionally, the amendment addresses consumer protection, infrastructure shaving, and integration of optical fiber in buildings.[94] In 2014, the telecommunications market in Morocco saw a significant price reduction (23%) for mobile services for the average outgoing voice call, which significantly boosted (15%) average usage volume per user[95]. Telecommunications sector revenues fell sharply due to the acceleration of competition in the mobile market (see Figure 1).

Figure 1: Annual change in real GDP and Telecom Market 2001-2012
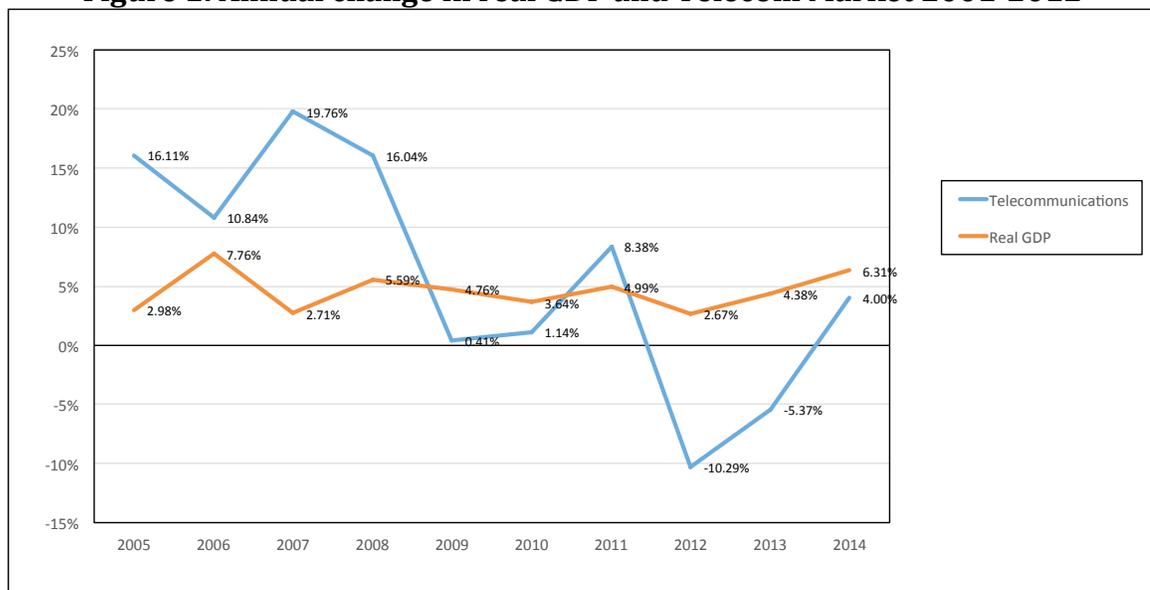
Sources: World Development Indicators (2015); ITU World Telecommunication/ICT Indicators 2015

During this time frame, the blended ARPU (Average Rate Per User) for Maroc Telecom has shown gradual decrease leading to $6.51 in the first quarter of 2015. On the other hand, the blended ARPU for Meditel and Inwi also noted a decline; Meditel ARPU rates dropped from

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[91] <http://www.budde.com.au/Research/Morocco-Telecoms-Mobile-and-Broadband.html>.

[92] "Information Insights: Morocco," Microsoft Communications and Media Sector. May 26, 2012.

[93] TeleGeography, 3 Jan 2014.

[94] *Ibid*.

[95] Source: ANRT, 3rd quarter of 2014.

$5.41 in 2010 to $5.05 in 2014 and Inwi ARPU rates dropped from $16.89 to $7.92 in the same period.

4. The economic impact of telecommunications in MENA countries

The impact of telecommunications on the economies of MENA countries needs to be assessed first in terms of the sector's direct impact, as measured by their contribution to the GDP and the employment opportunities generated by its operators and their local suppliers. On the other hand, telecommunications must also be viewed as a general purpose technology, meaning that it has an additional impact resulting from the positive externalities as reviewed in chapter 2. This chapter will assess the direct and indirect contribution that telecommunications has had thus far on economic development in the three MENA countries under study.

5.1. Direct economic contribution

The direct economic effects of telecommunications witnessed in the three MENA countries under study are sizable. Total revenues generated by the telecommunications industries amount to US$ 7,140 million, which represents 3.68 % of the three countries' GDP (see table 19).

Table 19. MENA countries: Telecommunications Industry Revenues (2014)

	Revenues	GDP	Percent of GDP
Jordan	$1,523	$ 35,765	4.26 %
Tunisia	$ 1,545	$ 48,533	3.18 %
Morocco	$ 4,072	$ 109,201	3.73 %
Total	$ 7,140	$ 193,499	3.68 %

Sources: International Telecommunications Union; GSMA Intelligence; Telecom Advisory Services analysis

In the case of Jordan, the telecommunications industry revenues have ranged between 3.63% and 5.02% of the country GDP since 2002.

Figure 2: Jordan: Telecommunications Sector Revenues (as percentage of GDP) (2002-2014)
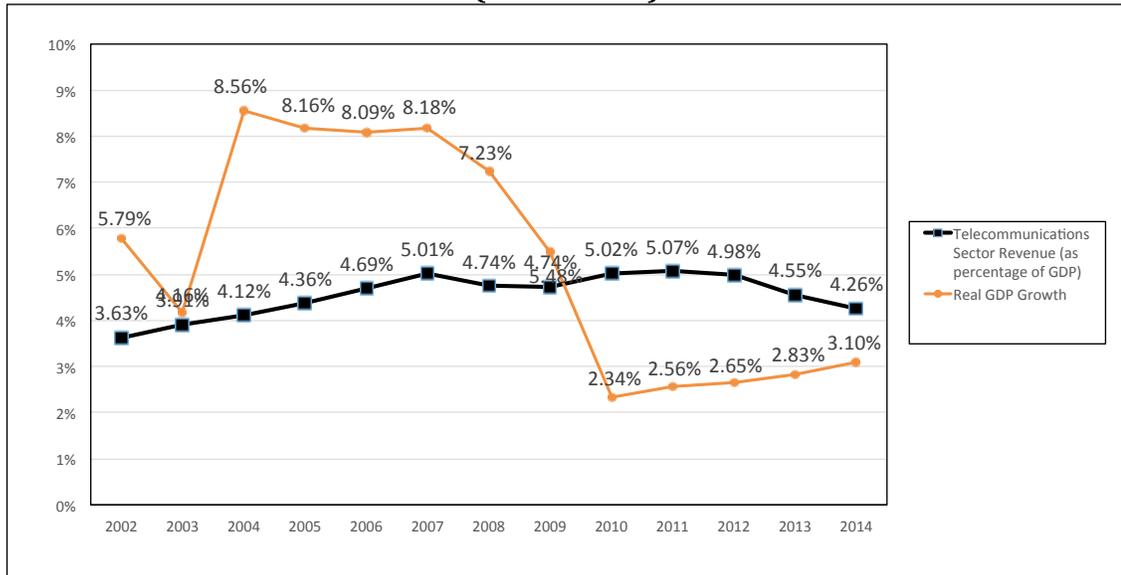
Source: World Development Indicators (2015); ITU World Telecommunication/ICT Indicators 2015

On the other hand, the Tunisian telecommunications industry revenues comprised 3.18 % of the country's GDP in 2014[96]. The sector represented a high point of 4.27 % of the GDP in 2010, but its weight has slowed down relative to the GDP, somewhat reducing its direct contribution (see figure 3).

Figure 3. Tunisia: Telecommunications Sector Revenues (as percentage of GDP) (2002-2014)
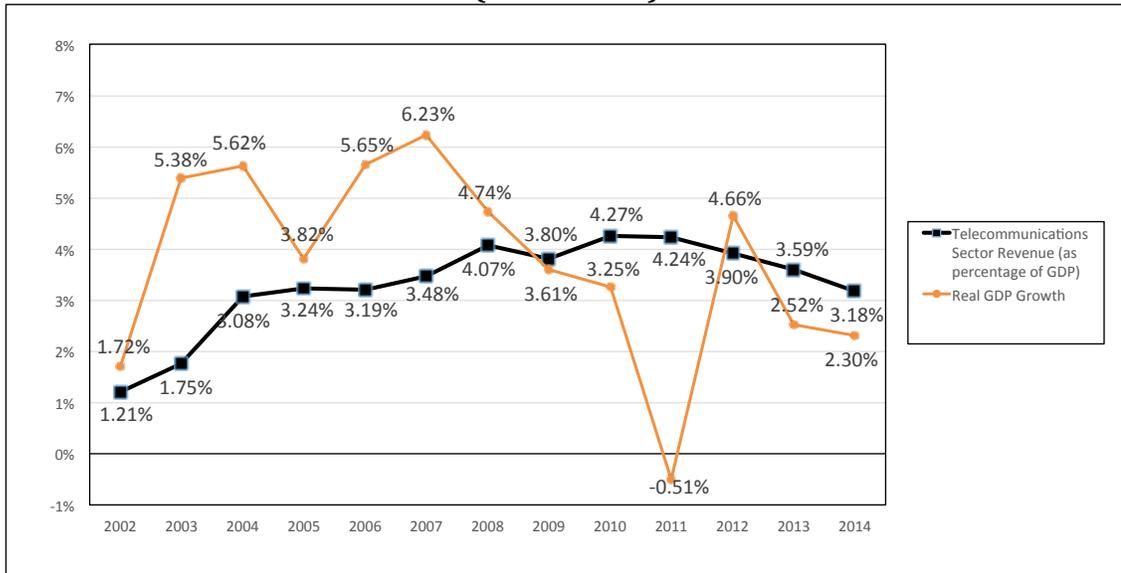
Source: World Development Indicators (2015); ITU World Telecommunication/ICT Indicators 2015

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[96] Source: ITU World Telecommunication/ICT Indicators 2015.

Finally, in the case of Morocco, the telecommunications industry revenues in 2014 represented 3.73% of the country's GDP[97]. After reaching a high point of 4.76% of the GDP in 2008, its overall importance has decreased one percentage point (see figure 4).

Figure 4. Morocco: Telecommunications Sector Revenues (as percentage of GDP) (2002-2014)
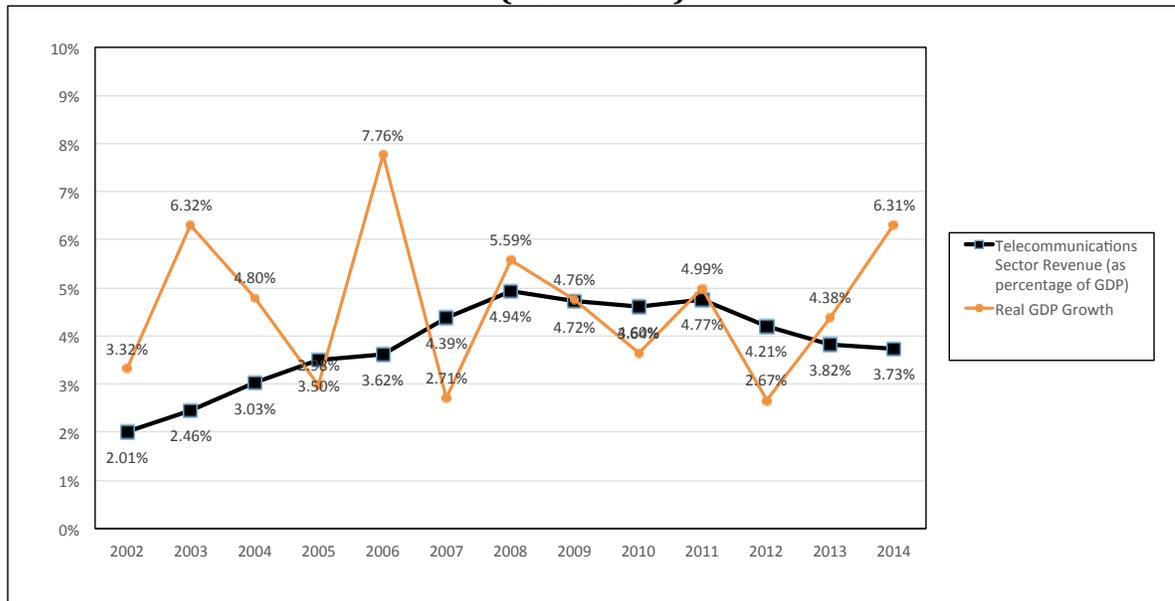
Source: World Development Indicators (2015); ITU World Telecommunication/ICT Indicators 2015

In addition to its direct monetary contribution to the economy, the telecommunications industry also fuelled job creation. In 2013, the telecommunications industry generated 28,714 direct jobs (by the respective operators) and an estimated 59,710 indirect jobs (by providers of inputs to the industry) within the three countries (see table 20).

Table 20. MENA Countries: Telecommunications Industry Employment (2013)

	Direct jobs	Indirect Jobs[98]	Direct and Indirect Jobs (*)	Country Workforce	Percent of Total Workforce
Jordan	4,214	7,710 (*)	11,924	1,198,000	1.00 %
Tunisia	11,000	10,000	21,000	3,978,000	0.53 %
Morocco	13,500	42,000	55,000	12,255,000	0.45 %
Total	28,714	59,710	87,924	17,431,00	0.50%

Note: (*) We believe this to be a low estimate given that Jordan counts 3600 points of sale of SIM card and 25,000 points to refill cards.
Sources: International Telecommunications Union; Telecommunications operators; GSMA Intelligence; Telecom Advisory Services analysis

Therefore, the sum of all jobs created by the telecommunications industry represents 0.50 % of the total workforce of all four countries.

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[97] Sources: International Telecommunications Union.

[98] Source: estimation by Telecom Advisory Services LLC based on the research-based assumptions contained in the digitization model in Katz, R., Koutroumpis, P. and Callorda, F. (2014). "Using a digitization index to measure economic and social impact of digital agendas", *Info*, January.

Beyond its direct contribution, the telecommunications industry also has an indirect effect on economic growth. The next section assesses the positive externalities of telecommunications in all three MENA country economies.

5.2. Indirect economic contribution

As shown in the literature reviewed above, beyond its direct economic contribution, telecommunications can have a positive effect on economic growth. This section assesses the positive externalities of telecommunications in all three MENA countries. As anticipated in the introduction, given the differing mobile telephony versus broadband penetration rates, the analysis of economic impact of both technologies will be conducted through different econometric models.

Regional and country-level statistical studies of ICT's impact on emerging economies usually suffer from a lack of data as the institutions and technical committees do not always collect information in a relatively frequent and consistent manner. This situation introduces a degree of complexity in the data mining phase. This study relied on several databases including the local regulator as well as GSMA Intelligence, and the International Telecommunications Union.

In-country operators compiled additional data. The operators provided telecommunications' costs and, in the case of mobile telephony, they were disagregated in pre- and post-paid ARPUs. Other macroeconomic metrics (GDP, fixed capital formation, education, labor force, etc.) are available from the World Bank and IMF. Market performance metrics (capex, revenues, etc.) are also available from local operators. A description of data sources is included in Appendix A.

5.2.1. Mobile telecommunications economic impact

To measure the indirect economic impact of mobile telephony on the GDP, a structural model consisting of four equations was constructed: an aggregate production function modeling the economy and, subsequently, three functions: demand, supply and output. The last three functions model the wireless market operation and, controlling for the reverse effects, the actual impact of the infrastructures is estimated. In the production function, GDP is linked to the fixed stock of capital, labor and the mobile infrastructure proxied by mobile penetration. In addition, a control variable accounting for oil prices and a dummy variable representing the socio-political shock of the Arab Spring were included. The demand function links mobile penetration to the average consumption propensity of individuals proxied by GDP per capita, the cost of a basic mobile service and the competition in the mobile market, measured by the HHI (Herfindahl Hirschman) index. The supply function links the aggregate mobile revenue to mobile price levels proxied by ARPU (Average Revenue per User), the industry concentration index of the mobile market (HHI), and GDP per capita. The infrastructure equation links annual change in mobile penetration to mobile revenues, used as a proxy of the capital invested in a country during one year.

The econometric specification of the model is as follows:

Aggregate Production function:
$$GDPit = a_1K_{it} + a_2L_{it} + a_3Mob\_Pen_{it} + a_4OilPrice_{it} + a_5Shock_{it} + e_{it} \qquad (1)$$

Demand function:
$$Mob\_Pen_{it} = b_1Rural_{it} + b_2Fixed_{it} + b_3Mob\_Price_{it} + b_4GDPC_{it} + b_5HHI_{it} + e_{it} \qquad (2)$$

Supply function:
$$Mob\_Rev_{it} = c_1MobPr_{it} + c_2GDPC_{it} + c_3HHI_{it} + \varepsilon_{3it} \qquad (3)$$

Output function:
$$\Delta Mob\_Pen_{it} = d_1Mob\_Rev_{it} + \varepsilon_{4it} \qquad (4)$$

These models found that mobile telephony (through 2G and 3G networks) has indirectly contributed the MENA countries' economies significantly during the last 13 years (2001-2014). The annualized average contribution to the Gross Domestic Product ranges between an estimated 0.124 % of GDP growth (for Jordan) to 1.43% (for Morocco) for every 1% increase of mobile penetration. Each model will be reviewed in turn.

The results of Jordan's mobile telecommunications model are presented in table 21.

Table 21. Jordan: Results of Mobile Telecommunications Model

```
. reg3 (lgdp1 lfcapital_3 llabedu_1 lmobusers lnoil primavera2 yr_1-yr_15 )  (lmobusers lnrural lnfix
> ed  lgdpc1  lmobcost hhi_mobile) (lrevenuemobile lgdpc1 lmobcost hhi_mobile) (mobgrowth lrevenuemo
> bile)

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	56	18	.020342	0.9982	32047.10	0.0000
lmobusers	56	5	.0660929	0.9920	8188.34	0.0000
lrevenuemo~e	56	3	.1337734	0.8659	417.81	0.0000
mobgrowth	56	1	.619227	0.5476	51.87	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	.4572255	.079413	5.76	0.000	.301579	.6128721
llabedu_1	-.1194211	.1761961	-0.68	0.498	-.4647592	.2259169
lmobusers	.1244647	.0418222	2.98	0.003	.0424948	.2064347
lnoil	-.0050288	.0194928	-0.26	0.796	-.043234	.0331764
primavera2	-.0046642	.016606	-0.28	0.779	-.0372113	.0278828
yr_1	(omitted)					
yr_2	-.3706046	.1006657	-3.68	0.000	-.5679057	-.1733035
yr_3	-.369367	.0963915	-3.83	0.000	-.5582909	-.1804431
yr_4	-.3605213	.0909407	-3.96	0.000	-.5387618	-.1822808
yr_5	-.382221	.080602	-4.74	0.000	-.540198	-.2242441
yr_6	-.4516534	.0628244	-7.19	0.000	-.574787	-.3285198
yr_7	-.4179018	.0562343	-7.43	0.000	-.5281191	-.3076845
yr_8	-.3386734	.0491304	-6.89	0.000	-.4349673	-.2423795
yr_9	-.2426455	.0366411	-6.62	0.000	-.3144607	-.1708302
yr_10	-.1497286	.0339035	-4.42	0.000	-.2161781	-.083279
yr_11	-.0706626	.0310764	-2.27	0.023	-.1315713	-.0097539
yr_12	-.0396814	.0288945	-1.37	0.170	-.0963135	.0169507
yr_13	-.0257143	.0219331	-1.17	0.241	-.0687025	.0172738
yr_14	-.0085673	.0166775	-0.51	0.607	-.0412546	.02412
yr_15	(omitted)					
_cons	-.4783899	.5337441	-0.90	0.370	-1.524509	.5677293
lmobusers						
lnrural	-11.94281	1.29964	-9.19	0.000	-14.49006	-9.39556
lnfixed	1.809357	.1785271	10.13	0.000	1.45945	2.159264
lgdpc1	.0023603	.2084703	0.01	0.991	-.4062339	.4109546
lmobcost	-.763087	.0985955	-7.74	0.000	-.9563305	-.5698434
hhi_mobile	-.7116089	.1358069	-5.24	0.000	-.9777855	-.4454323
_cons	42.68361	5.097892	8.37	0.000	32.69192	52.6753
lrevenuemo~e						
lgdpc1	-.2015332	.1599081	-1.26	0.208	-.5149474	.1118809
lmobcost	-.1619883	.1142528	-1.42	0.156	-.3859196	.061943
hhi_mobile	-1.20187	.139146	-8.64	0.000	-1.474591	-.929149
_cons	31.06297	2.081509	14.92	0.000	26.98329	35.14266
mobgrowth						
lrevenuemo~e	-1.517594	.2107247	-7.20	0.000	-1.930607	-1.104582
_cons	29.18191	3.992632	7.31	0.000	21.3565	37.00732

```
Endogenous variables:   lgdp1 lmobusers lrevenuemobile mobgrowth
Exogenous variables:    lfcapital_3 llabedu_1 lnoil primavera2 yr_1 yr_2 yr_3
     yr_4 yr_5 yr_6 yr_7 yr_8 yr_9 yr_10 yr_11 yr_12 yr_13 yr_14 yr_15
     lnrural lnfixed lgdpc1 lmobcost hhi_mobile
```

Source: TAS analysis

The model results confirm the economic spillover of mobile telecommunications in Jordan. In addition, the structural model yields other interesting findings:

- Wireless prices affect both the demand (coefficient: -0.76) although the coefficient of impact of prices on the supply of services is not statistically significant
- Competition has positively affected pricing, yielding lower revenue streams (coefficient: -1.202)
- Incomes do not appear to be statistically significant in their impact on revenues and adoption (see second and third equation); this is because the inclusion of the rural population variable results in lower penetration with higher rural population (coefficient: -11.94)

Likewise, econometric models found that mobile voice telecommunications (through 2G and 3G networks) has significantly affected the economy of Tunisia between 2001 and

2014. The annualized average contribution to the Gross Domestic Product is equal to an estimated 0.108 % of GDP growth for every 1% increase of mobile penetration (see Table 22).

Table 22. Tunisia: Results of Mobile Telecommunications Model

```
Three-stage least-squares regression

Equation          Obs   Parms      RMSE    "R-sq"       chi2         P

lgdp1              57     18    .0088718   0.9966   19240.52    0.0000
lmobusers          57      4    .2423241   0.9537    1365.93    0.0000
lrevenuemo~e       57      3    .2663906   0.9004     610.42    0.0000
mobgrowth          57      1    .0962772   0.6396      88.55    0.0000
```

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	.0631113	.0336854	1.87	0.061	-.0029108	.1291335
llabedu_1	-.1961728	.2125332	-0.92	0.356	-.6127302	.2203847
lmobusers	.1077474	.0370625	2.91	0.004	.0351062	.1803886
lnoil	.0182185	.009224	1.98	0.048	.0001397	.0362973
yr_2	-.0552041	.018177	-3.04	0.002	-.0908304	-.0195779
yr_3	-.0888612	.025598	-3.47	0.001	-.1390325	-.03869
yr_4	-.0951818	.0289987	-3.28	0.001	-.1520183	-.0383454
yr_5	-.0852786	.0328091	-2.60	0.009	-.1495834	-.0209739
yr_6	-.0995876	.0385312	-2.58	0.010	-.1751074	-.0240679
yr_7	-.0823749	.0419626	-1.96	0.050	-.1646202	-.0001296
yr_8	-.0366587	.043999	-0.83	0.405	-.1228952	.0495777
yr_9	-.0108324	.0421276	-0.26	0.797	-.0934011	.0717362
yr_10	.0191241	.0411598	0.46	0.642	-.0615477	.0997959
yr_11	.0337888	.0427182	0.79	0.429	-.0499373	.1175149
yr_12	.005356	.0439213	0.12	0.903	-.0807281	.0914402
yr_13	.0270517	.0463486	0.58	0.559	-.0637899	.1178933
yr_14	.050135	.0470192	1.07	0.286	-.0420208	.1422909
yr_15	.0709852	.0480626	1.48	0.140	-.0232158	.1651861
_cons	9.380778	.6159412	15.23	0.000	8.173556	10.588
lmobusers						
lnrural	2.170195	.4461435	4.86	0.000	1.29577	3.04462
lgdpc1	3.020386	1.10634	2.73	0.006	.8519997	5.188773
lmobcost	-.1118245	.3283777	-0.34	0.733	-.755433	.531784
hhi_mobile	-2.663461	.2525595	-10.55	0.000	-3.158469	-2.168454
_cons	39.39915	6.483287	6.08	0.000	26.69215	52.10616
lrevenuemo~e						
lgdpc1	3.024828	1.185246	2.55	0.011	.7017878	5.347868
lmobcost	.8046495	.3517575	2.29	0.022	.1152176	1.494082
hhi_mobile	-2.66219	.2710937	-9.82	0.000	-3.193524	-2.130856
_cons	59.94693	6.816433	8.79	0.000	46.58697	73.30689
mobgrowth						
lrevenuemo~e	-.1358309	.0144349	-9.41	0.000	-.1641228	-.1075391
_cons	2.733492	.2801069	9.76	0.000	2.184492	3.282491

```
Endogenous variables:   lgdp1 lmobusers lrevenuemobile mobgrowth
Exogenous variables:    lfcapital_3 llabedu_1 lnoil yr_2 yr_3 yr_4 yr_5 yr_6
     yr_7 yr_8 yr_9 yr_10 yr_11 yr_12 yr_13 yr_14 yr_15 lnrural lgdpc1
     lmobcost hhi_mobile
```

Source: TAS analysis

The model results confirm the economic spillover of mobile telecommunications in Tunisia. In addition, the structural model yields other interesting findings:

- Wireless prices affect wireless supply (coefficient: 0.804), while the coefficient of impact of prices on the demand of services is not statistically significant
- Income, as measured by GDP per capita, seems to affect positively wireless penetration (coefficient: 3.020) and wireless revenues (coefficient: 3.024)

Finally, the econometric models also found that mobile voice telecommunications (through

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2G and 3G networks) have significantly affected the economy of Morocco between 2001 and 2014. The annualized average contribution to the Gross Domestic Product in this case is equal to an estimated 0.143 % of GDP growth for every 1% increase of mobile penetration (see Table 23).

Table 23. Morocco: Results of Mobile Telecommunications Model

```
. reg3 (lgdp1 lfcapital_3 llabedu_1 lmobusers primavera2 yr_6-yr_15 ) (lmobusers lnrural lnfixed lgdp
> c1  lmobcost hhi_mobile) (lrevenuemobile lgdpc1 lmobcost hhi_mobile) (mobgrowth lrevenuemobile) if
> yr>2005 | (yr >2004 & qt>3)

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	37	13	.0079495	0.9979	19619.13	0.0000
lmobusers	37	5	.0387255	0.9880	4066.34	0.0000
lrevenuemo~e	37	3	.0390407	0.9722	1337.82	0.0000
mobgrowth	37	1	.0272389	0.1064	7.03	0.0080

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	.5164588	.061403	8.41	0.000	.3961112	.6368064
llabedu_1	.1670606	.1022323	1.63	0.102	-.0333111	.3674322
lmobusers	.1433419	.0625775	2.29	0.022	.0206922	.2659916
primavera2	-.0136336	.0073017	-1.87	0.062	-.0279448	.0006775
yr_6	-.0046694	.0282157	-0.17	0.869	-.0599711	.0506323
yr_7	.0016054	.0249325	0.06	0.949	-.0472613	.0504722
yr_8	-.008189	.0207612	-0.39	0.693	-.0488801	.0325022
yr_9	-.0031611	.0183737	-0.17	0.863	-.0391729	.0328507
yr_10	.0171095	.014904	1.15	0.251	-.0121018	.0463207
yr_11	.0105448	.0090002	1.17	0.241	-.0070953	.0281849
yr_12	(omitted)					
yr_13	-.0244753	.0077048	-3.18	0.001	-.0395765	-.0093741
yr_14	-.0079258	.0092193	-0.86	0.390	-.0259954	.0101437
yr_15	.0312151	.0108593	2.87	0.004	.0099313	.0524988
_cons	-1.352781	.3356156	-4.03	0.000	-2.010576	-.6949865
lmobusers						
lnrural	-2.322509	1.109013	-2.09	0.036	-4.496135	-.1488832
lnfixed	.0860207	.0339769	2.53	0.011	.0194272	.1526143
lgdpc1	.8911315	.1771286	5.03	0.000	.5439659	1.238297
lmobcost	-.0354179	.0870982	-0.41	0.684	-.2061272	.1352913
hhi_mobile	-.6758909	.103324	-6.54	0.000	-.8784022	-.4733796
_cons	12.91373	4.519072	2.86	0.004	4.056515	21.77095
lrevenuemo~e						
lgdpc1	1.390007	.0729559	19.05	0.000	1.247016	1.532998
lmobcost	.8291106	.0871102	9.52	0.000	.6583777	.9998435
hhi_mobile	-.8725899	.0897652	-9.72	0.000	-1.048526	-.6966534
_cons	16.83843	.9394508	17.92	0.000	14.99714	18.67972
mobgrowth						
lrevenuemo~e	-.0504817	.0190341	-2.65	0.008	-.0877878	-.0131756
_cons	1.066326	.389812	2.74	0.006	.3023082	1.830343

```
Endogenous variables:  lgdp1 lmobusers lrevenuemobile mobgrowth
Exogenous variables:   lfcapital_3 llabedu_1 primavera2 yr_6 yr_7 yr_8 yr_9
     yr_10 yr_11 yr_12 yr_13 yr_14 yr_15 lnrural lnfixed lgdpc1 lmobcost
     hhi_mobile
```

Source: TAS analysis

The model results confirm the economic spillover of mobile telecommunications in Morocco. In addition, the structural model yields other interesting findings:

- Wireless prices affect wireless supply (coefficient: 0.829) although the coefficient of impact of prices on the demand of services is not statistically significant

- Income, as measured by GDP per capita, seems to affect positively wireless penetration (coefficient: 0.891) and wireless revenues (coefficient: 1.390)

Looking at the results in light of the specification of similar models implemented for other countries indicates that the economic impact of wireless telephony in Morocco is fairly consistent with an exponential growth impact curve and return to scale as drawn based on other countries (see Figure 5).

Figure 5. Comparative Mobile Telecomunications Economic Impact vs. Wireless Penetration
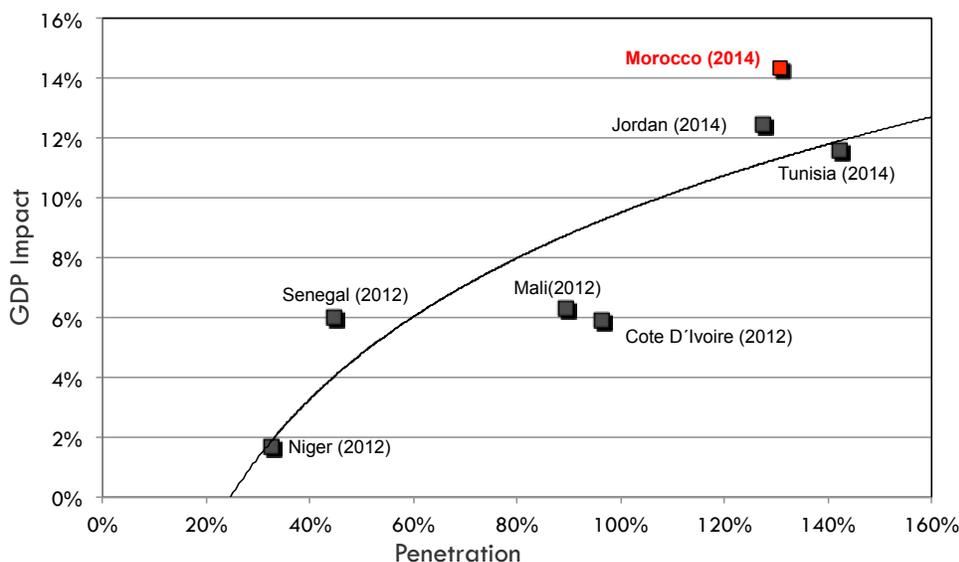
Source: TAS analysis

All three MENA countries – Morocco, Tunisia, and Jordan - exhibit fairly consistent GDP impact of mobile telecommunications. Given that mobile penetration in MENA is higher than the one registered in 2012 in Francophone Africa, the results confirm the postulate that economic impact increases with adoption of the technology.

By relying on the country specific coefficients, the actual contribution of wireless telecommunications to each of the countries' GDPs was estimated. For this purpose, the compound annual growth rate of wireless penetration between 2001 and 2014 (formula 5) was multiplied by the coefficient of economic impact derived from the econometric model presented in Tables 21, 22, and 23:

CAGR = (Wireless penetration 4Q2014 -Wireless penetration 4Q2001) ^ (1/13)-1   (5) [99]

Impact of wireless on GDP (2001-2014)= CAGR*Coefficient of Impact   (6)

Following this, the annual impact of wireless on a country's GDP was divided by the CAGR of GDP (formula 7) and multiplied by the incremental GDP between 2001 and 2014

---

[99] For Tunisia, the starting point was 4Q2013.

(formula 8).

% impact of wireless to GDP growth = Annual impact of wireless on GDP / CAGR GDP (2001-20124)   (7)

Impact of Wireless on Incremental GDP = Incremental GDP (2014-2001) * % impact of wireless to GDP growth (8)

By dividing the total impact of wireless on incremental GDP growth between 2014 and 2001 by the number of years, the annual impact was estimated for each country (see table 24).

Table 24. MENA countries: Annual Mobile Telecommunications Impact on GDP

Item	Component	Jordan	Tunisia	Morocco	Source and / or estimation formula
1	Annual contribution of wireless telephony to GDP growth (for every 10% increase in wireless penetration)	1.24 %	1.08 %	1.43 %	Coefficient resulting from structural model
2	Mobile telecommunications penetration 4Q2014	127.49 %	57.77 %	130.81 %	GSMA Intelligence
3	Mobile penetration 4Q2001	17.67 %	14.36 % (*)	16.50 %	GSMA Intelligence
4	Compound Annual Growth Rate (CAGR) of mobile telecommunications penetration	16.42 %	13.49 %	17.26 %	(Mobile telecommunications penetration 4Q2014/4Q2001)^(1/13 years)-1 (**)
5	Annual impact of mobile telecommunications on GDP	2.04 %	1.45 %	2.47 %	(Annual impact)/10 * (CAGR Mobile telecommunications penetration)
6	CAGR GDP (2001-2014)	11.22 %	5.32 % (***)	8.52 %	(GDP 4Q2014/GDP 4Q2001) ^ (1/13 years)-1
7	Percent contribution of wireless telephony to GDP growth	18.21 %	27.26 % (****)	29.05 %	Annual impact of mobile telecommunications on GDP / CAGR GDP (2001-2014)
8	Incremental GDP growth (4Q2014/4Q2001)	US$ 26,790 M	US$ 21,099 M (*****)	US$ 71,476 M	GDP 4Q2014 - GDP 4Q2001
9	Total Impact of Wireless Telephony on Incremental GDP growth	US$ 4,879 M	US$ 5,764 M (******)	US$ 20,761 M	Incremental GDP (4Q2014/4Q2001) * % contribution of mobile telecommunications to GDP growth
10	Annual impact of mobile telecommunications on GDP	US$ 375 M	US$ 524 M (*******)	US$ 1,597 M	Total impact /13 years

(*) Starting point 4Q2003
(**) For Tunisia, (Mobile unique subscribers penetration 4Q2014/4Q2003)^(1/11 years)-1
(***) For Tunisia, (GDP 4Q2014/GDP 4Q2003) ^ (1/11 years)-1
(****) For Tunisia, Annual impact of mobile telecommunications on GDP / CAGR GDP (2003-2014)
(*****) For Tunisia, GDP 4Q2014 - GDP 4Q2003
(******) For Tunisia, Incremental GDP (4Q2014/4Q2003) * % contribution of mobile telecommunications to GDP growth
(*******) For Tunisia, Total impact /11 years
Source: TAS analysis

According to the formulae presented in table 24, the indirect annual contribution of wireless telephony to the GDP was US$ 375 million for Jordan, US$ 524 million for Tunisia,

and US$ 1,597 million for Morocco.

5.2.3 Mobile Broadband economic impact

To analyze mobile broadband's impact on the MENA countries' economy, we utilized a model similar to the mobile telecommunications structural model presented above. The model also consists of four equations: an aggregate production function modeling the operation of the economy and subsequently three demand, supply and output functions. In the production function, GDP is linked to the fixed stock of capital, labor and the mobile infrastructure proxied by mobile broadband penetration. The latter functions model the mobile broadband market operation and estimate the economic impact of mobile broadband while controlling for the reverse effects. The demand function links mobile broadband penetration to fixed broadband penetration (to understand substitution dynamics), the average consumption propensity of individuals proxied by GDP per capita, the price of a basic mobile broadband service (price of a monthly subscription), and the level of competitive intensity in the mobile broadband sector, measured by the HHI index. The supply function links the aggregate mobile broadband revenue to the relevant price levels, level of competitive intensity, and the GDP per capita. The infrastructure equation links annual change in mobile broadband penetration to the market revenues, used as a proxy of the capital invested in a country during one year.

The econometric specification of the model is as follows:

$$\text{Aggregate Production function:}$$
$$GDP_{it} = a_1 K_{it} + a_2 L_{it} + a_3 Mob\_Bob\_Pen_{it} + e_{it} \tag{6}$$

$$\text{Demand function:}$$
$$Mob\_Bob\_Pen_{it} = b_1 FBB\_Pen_{it} + b_2 Mob\_Pen_{it} + b_3 Mob\_Bob\_Price_{it} + b_4 GDPC_{it} + b_5 HHI\_MBB_{it} + e_{it} \tag{7}$$

$$\text{Supply function:}$$
$$Mob\_Bob\_Rev_{it} = c_1 Mob\_Bob\_Pr_{it} + c_2 GDPC_{it} + c_3 HHI\_MBB_{it} + \varepsilon_{3it} \tag{8}$$

$$\text{Output function:}$$
$$\text{Variation in } MBB\_Pen_{it} = d_1 MBB\_Rev_{it} + \varepsilon_{3it} \tag{9}$$

The models found that mobile broadband has affected the economy of Jordan between 2011 and 2014. The annualized average contribution to the Gross Domestic Product is equal to an estimated 0.039 % of GDP growth for every 1% increase of mobile broadband penetration (see Table 25).

Table 25. Jordan: Results of Mobile Broadband Model

```
. reg3 (lgdp1 lfcapital_3 llabedu_1 lmbbusers lnoil primavera2 yr_10-yr_15 ) (lmbbusers lnrural lmobu
> sers  lgdpc1  lmbbcost hhi_mb)     (lrevenuembb     lgdpc1 lmbbcost hhi_mb)     (mbbgrowth lrevenuem
> bb)    if yr>2008

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	24	10	.0054849	0.9985	16895.20	0.0000
lmbbusers	24	5	.2172135	0.9898	2624.70	0.0000
lrevenuembb	24	3	.4523575	0.9466	431.37	0.0000
mbbgrowth	24	1	.4457181	0.1295	3.12	0.0774

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	.4627932	.0608062	7.61	0.000	.3436153	.5819711
llabedu_1	-.2228202	.0753224	-2.96	0.003	-.3704494	-.075191
lmbbusers	.0387972	.0053984	7.19	0.000	.0282165	.049378
lnoil	.0471987	.0123373	3.83	0.000	.0230179	.0713794
primavera2	-.0269233	.0050067	-5.38	0.000	-.0367362	-.0171103
yr_10	.0476769	.0222135	2.15	0.032	.0041393	.0912145
yr_11	.0321317	.0188947	1.70	0.089	-.0049013	.0691646
yr_12	-.0131287	.0157971	-0.83	0.406	-.0440905	.0178331
yr_13	-.0116568	.0115384	-1.01	0.312	-.0342717	.010958
yr_14	-.0077203	.0068132	-1.13	0.257	-.021074	.0056333
yr_15	(omitted)					
_cons	.1105626	.3044989	0.36	0.717	-.4862443	.7073696
lmbbusers						
lnrural	205.752	36.81618	5.59	0.000	133.5937	277.9104
lmobusers	-.2876481	2.192606	-0.13	0.896	-4.585077	4.009781
lgdpc1	69.46864	5.917436	11.74	0.000	57.87068	81.0666
lmbbcost	2.378411	4.211616	0.56	0.572	-5.876205	10.63303
hhi_mb	-1.66111	.3526017	-4.71	0.000	-2.352196	-.9700229
_cons	-1155.859	119.9516	-9.64	0.000	-1390.96	-920.7583
lrevenuembb						
lgdpc1	48.90461	11.55968	4.23	0.000	26.24805	71.56116
lmbbcost	15.48514	4.279883	3.62	0.000	7.096724	23.87356
hhi_mb	-2.86353	.7158797	-4.00	0.000	-4.266629	-1.460432
_cons	-403.1933	108.6826	-3.71	0.000	-616.2073	-190.1793
mbbgrowth						
lrevenuembb	-.0820195	.0464399	-1.77	0.077	-.17304	.009001
_cons	1.714387	.7636923	2.24	0.025	.217578	3.211197

```
Endogenous variables:  lgdp1 lmbbusers lrevenuembb mbbgrowth
Exogenous variables:   lfcapital_3 llabedu_1 lnoil primavera2 yr_10 yr_11
    yr_12 yr_13 yr_14 yr_15 lnrural lmobusers lgdpc1 lmbbcost hhi_mb
```

Source: TAS analysis

The model results confirm the economic spillover of mobile broadband in Jordan. In addition, the structural model yields other interesting findings:

- Mobile broadband prices has positively affected revenues (coefficient: 15.485) but has not statically significant effect on mobile broadband penetration
- Competition has positively affected mobile broadband penetration (a negative relation between HHI and penetration of -1.661)
- Incomes seem to affect positively mobile broadband penetration (coefficient: 69.468) and mobile broadband revenues (coefficient: 48.904)
- Oil prices has a positive effect on GDP growth (coefficient: 0.047) and the Arab spring a negative effect (coefficient: -0.026)

The models found that mobile broadband has positively contributed to the economy of Tunisia between 2010 and 2014. The annualized average contribution to the Gross

Domestic Product is equal to an estimated 0.020 % of GDP growth for every 1% increase of mobile penetration (see Table 26).

Table 26. Tunisia: Results of Mobile Broadband Model

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	18	9	.0050752	0.9795	7.84e+07	0.0000
lmbbusers	18	6	.0770461	0.9970	7274.64	0.0000
lrevenuembb	18	3	.1526143	0.9845	1197.57	0.0000
mbbgrowth	18	1	.1949577	0.0191	0.48	0.4868

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lgdp1						
lfcapital_3	.1450856	.0458037	3.17	0.002	.055312	.2348591
llabedu_1	-.2864264	.2810881	-1.02	0.308	-.837349	.2644963
lmbbusers	.0202782	.003148	6.44	0.000	.0141081	.0264482
lnoil	.0073267	.0151581	0.48	0.629	-.0223826	.037036
yr_11	9.801791	.9393219	10.43	0.000	7.960754	11.64283
yr_12	9.773851	.9374671	10.43	0.000	7.936449	11.61125
yr_13	9.773301	.9364962	10.44	0.000	7.937802	11.6088
yr_14	9.775144	.9374358	10.43	0.000	7.937804	11.61248
yr_15	9.787198	.9380011	10.43	0.000	7.94875	11.62565
_cons	(omitted)					
lmbbusers						
lfbbusers	-3.982385	.7716285	-5.16	0.000	-5.494749	-2.470021
lmobusers	1.114535	.7648085	1.46	0.145	-.3844616	2.613533
lnrural	-6.694704	18.66618	-0.36	0.720	-43.27975	29.89034
lgdpc1	5.618305	2.24581	2.50	0.012	1.216597	10.02001
lmbbcost	-3.705277	.6123635	-6.05	0.000	-4.905487	-2.505067
hhi_mb	-.7447373	.2580336	-2.89	0.004	-1.250474	-.2390007
_cons	86.72354	60.41306	1.44	0.151	-31.68387	205.131
lrevenuembb						
lgdpc1	17.206	2.698812	6.38	0.000	11.91642	22.49557
lmbbcost	-3.16331	.6010883	-5.26	0.000	-4.341421	-1.985198
hhi_mb	-.6054903	.3791695	-1.60	0.110	-1.348649	.1376683
_cons	146.272	16.35298	8.94	0.000	114.2207	178.3232
mbbgrowth						
lrevenuembb	-.0261056	.0375375	-0.70	0.487	-.0996778	.0474665
_cons	.7538324	.6810689	1.11	0.268	-.5810381	2.088703

Endogenous variables: lgdp1 lmbbusers lrevenuembb mbbgrowth
Exogenous variables: lfcapital_3 llabedu_1 lnoil yr_11 yr_12 yr_13 yr_14 yr_15 lfbbusers lmobusers lnrural lgdpc1 lmbbcost hhi_mb

Source: TAS analysis

The model results confirm the economic spillover of mobile broadband in Tunisia. In addition, the structural model yields other interesting findings:

- Mobile broadband prices have an expected negative impact on mobile broadband penetration, underlying elasticity of demand (coefficient: -3.705)
- Industry concentration has a negative effect on mobile broadband penetration (a negative relation between HHI and penetration of -0.744), which means that with a lower HHI (meaning more competition) mobile broadband adoption increases

- The coefficient of competitive intensity does not have a statistically significant impact on mobile broadband revenues
- Incomes affect positively mobile broadband revenues (coefficient: 17.206) and penetration (coefficient: 5.618)

Despite mobile broadband impact on Tunisia's GDP, its recent launch prevents from estimating its contribution. Nevertheless, we believe this effect is already captured within the impact of mobile telecommunications.

Finally, the econometric models found that mobile broadband has affected the economy of Morocco between 2011 and 2014. The annualized average contribution to the Gross Domestic Product is equal to an estimated 0.054 % of GDP growth for every 1% increase of mobile penetration (see Table 27).

Table 27. Morocco: Results of Mobile Broadband Model

```
. reg3 (lgdp1 lfcapital_3 llabedu_1 lmbbusers  yr_11-yr_15) (lmbbusers lmobusers lfbbusers   lgdpc1
> lmbbcost hhi_mb)     (lrevenuembb    lgdpc1 lmbbcost hhi_mb)    (mbbgrowth lrevenuembb)

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	18	8	.0030597	0.9968	2.10e+07	0.0000
lmbbusers	18	5	.079871	0.9572	449.01	0.0000
lrevenuembb	18	3	.1132402	0.8906	148.13	0.0000
mbbgrowth	18	1	.0683231	0.0074	0.99	0.3189

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	1.78021	.1030613	17.27	0.000	1.578213	1.982206
llabedu_1	-.839823	.0856092	-9.81	0.000	-1.007614	-.6720321
lmbbusers	.0541444	.0127535	4.25	0.000	.029148	.0791408
yr_11	-6.416927	.5719322	-11.22	0.000	-7.537894	-5.295961
yr_12	-6.41873	.5716253	-11.23	0.000	-7.539095	-5.298365
yr_13	-6.430542	.5704631	-11.27	0.000	-7.548629	-5.312455
yr_14	-6.438692	.571374	-11.27	0.000	-7.558564	-5.318819
yr_15	-6.433555	.5719983	-11.25	0.000	-7.554651	-5.312459
_cons	(omitted)					
lmbbusers						
lmobusers	4.234589	.6043939	7.01	0.000	3.049999	5.41918
lfbbusers	-1.10417	.3821251	-2.89	0.004	-1.853122	-.3552187
lgdpc1	.2238495	1.190083	0.19	0.851	-2.108671	2.55637
lmbbcost	-.4494617	.189812	-2.37	0.018	-.8214863	-.0774371
hhi_mb	1.145904	1.273565	0.90	0.368	-1.350238	3.642045
_cons	-26.65321	9.386776	-2.84	0.005	-45.05096	-8.255468
lrevenuembb						
lgdpc1	3.132327	1.638031	1.91	0.056	-.0781541	6.342808
lmbbcost	-.212624	.1395278	-1.52	0.128	-.4860935	.0608454
hhi_mb	10.78122	1.786293	6.04	0.000	7.280146	14.28229
_cons	-90.63119	12.41478	-7.30	0.000	-114.9637	-66.29866
mbbgrowth						
lrevenuembb	-.0480837	.0482382	-1.00	0.319	-.1426288	.0464614
_cons	.9331593	.8444628	1.11	0.269	-.7219574	2.588276

```
Endogenous variables:  lgdp1 lmbbusers lrevenuembb mbbgrowth
Exogenous variables:   lfcapital_3 llabedu_1 yr_11 yr_12 yr_13 yr_14 yr_15
      lmobusers lfbbusers lgdpc1 lmbbcost hhi_mb
```

Source: TAS analysis

The model results confirm the economic spillover of mobile broadband in Morocco. In addition, the structural model yields other interesting findings:

- Mobile broadband prices have an expected negative (cross elastic) relationship with mobile broadband penetration (coefficient: -0.449);
- Competition has negatively affect mobile broadband revenues (a positive relation between HHI and penetration of 10.781) but has not statistically significant impact on mobile broadband penetration;
- Incomes seem to affect positively mobile broadband revenues (coefficient: 3.132) but does not have a statistically significant impact on mobile broadband penetration.

The mobile broadband GDP impact coefficient of Jordan, Tunisia, and Morocco can be compared with estimates calculated using similar structural models (Katz et al, 2012; Katz et al, 2013). These estimates indicate that, similar to the wireless telecommunications contribution discussed above, mobile broadband exhibits a return to scale (in other words, the higher the penetration, the larger the economic effect). However, in the case of mobile broadband, the shape of the curve might indicate lower returns to scale than in the case of wireless telephony (see figure 6).

Figure 6. Estimates Comparative Mobile Broadband Economic Impact vs. Mobile Broadband Penetration[100]
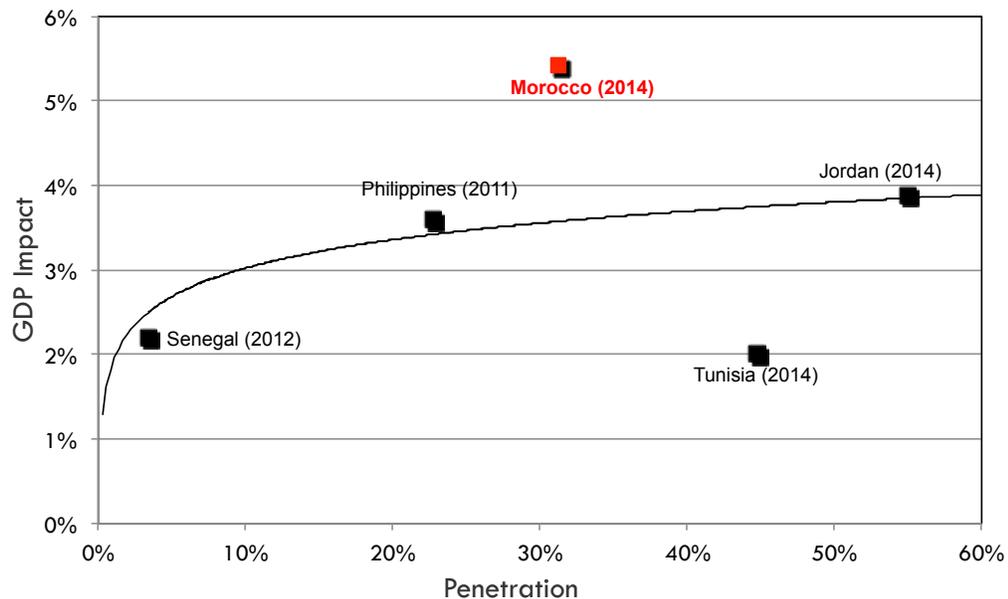
Source: TAS analysis

This lower return to scale could be due to two factors. First, initial mobile broadband usage could be concentrated on applications that might have some economic impact. For example, at initial stages of diffusion, mobile broadband usage is concentrated on social network access, which drives primarily the creation of a digital advertising industry. Along these lines, another potential explanation - about which we remain cautious - is that the

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[100] Coefficients plotted at 10% penetration.

economic contribution of mobile broadband should be accelerating over time due to the launch of new services, such as financial services, that rely on telecommunications to reach consumers.

The actual contribution of mobile technology to the economiesof all three countries was calculated by multiplying the compound annual growth rate of mobile broadband penetration between 4Q2011 and 4Q2014[101] by the coefficient of economic impact derived from the econometric model presented in tables 25, 26, and 27 (Formula 6):

CAGR = (Mobile broadband penetration 4Q2014 (31.27%)-Mobile broadband penetration 4Q2011 (17.12%)) ^ (1/3 years)-1   (5)

The CAGR for mobile broadband in Morocco for the period 4Q2011 - 4Q2014 is 22.24%.

Impact of mobile broadband on GDP (4Q2011-4Q2014)= CAGR (22.24%)*Coefficient of Impact (0.054)   (6)

Table 28. Estimation of mobile broadband indirect contribution to MENA countries economic growth between 2011 and 2014

Item	Factor	Jordan	Morocco	Source and/or estimation formula
1	Annual contribution of mobile broadband to GDP growth (for a 10% increase in additional penetration)	0.39 %	0.54 %	Coefficient resulting from structural model
2	Mobile broadband penetration 4Q2014	55.34 %	31.27 %	GSMA Intelligence
3	Mobile broadband penetration 4Q2011	23.58 %	17.12 %	GSMA Intelligence
4	Compound Annual Growth Rate (CAGR) of mobile broadband penetration	32.89 %	22.24 %	(Mobile broadband penetration 4Q2014/4Q2011) ^(1/3 years)-1
5	Annual impact of mobile broadband on GDP	1.28 %	1.20 %	(Annual impact)/10 * (CAGR Mobile broadband penetration)
6	CAGR GDP (2011-2014)	7.39 %	3.25 %	(GDP 4Q2014/ GDP 4Q2011)^(1/3 years)-1
7	Percent contribution of mobile broadband to GDP growth	17.28 %	37.05 %	Annual impact of mobile broadband on GDP / CAGR GDP (2011-2014)
8	Incremental GDP growth (2011-2014)	US$ 6,884 M	US$ 9,990 M	GDP 4Q2014- GDP 4Q2011
9	Total impact of mobile broadband on incremental GDP growth	US$ 1,189 M	US$ 3,701 M	Incremental GDP (4Q2014/4Q2011) * % contribution of mobile broadband to GDP growth
10	Annual impact of mobile broadband on GDP	US$ 396 M	US$ 1,234 M	Total impact / 3 years

Source: Telecom Advisory Services analysis

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[101] Considering that between the second and fourth quarter of 2011, mobile broadband penetration increased significantly (from 12.68% to 17.12%), that period was excluded from the impact analysis. Thus, mobile telecommunications contribution was estimated between 4Q2011 and 4Q2014.

According to the formula in table 28, the annual contribution on the Jordanian GDP from mobile broadband amounts to 1.28% of GDP. Based on the difference between 2011 GDP of US$ 28,881 million and 2014 GDP of US$ 35,765 million, which yields a CAGR of 7.39%[102],the indirect annual contribution of mobile broadband to the GDP of Jordan amounts to US$ 396 million.

In the case of Tunisia, the annual contribution on GDP from mobile broadband amounts to 1.72% of GDP. Based on the difference between 2012 GDP of US$ 45,239 million and 2014 GDP of US$ 48,553 million, which yields a CAGR of 3.60%[103],the indirect annual contribution of mobile broadband to the GDP of Tunisia amounts to US$ 791million. However, mobile broadband more recent deployment prevents estimating this effect with statistical significance.

Finally, for Morocco, according to the formulae, the annual contribution on GDP from mobile broadband amounts to 1.20% of GDP. Based on the difference between 2011 GDP of US$ 99,211 million and 2014 GDP of US$ 109,201 million, which yields a CAGR of 3.25%[104],the indirect annual contribution of mobile broadband to the GDP of Morocco amounts to US$ 1,234 million.

It should be mentioned, however, that for purposes of assessing total indirect contribution, mobile broadband impact is also included in the contribution of mobile telecommunications.

5.2.4 Fixed Broadband economic impact

To analyze fixed broadband's impact on the MENA countries' economy, we utilized a model similar to the mobile telecommunications structural one. The model also consists of four equations: an aggregate production function modeling the operation of the economy and subsequently three demand, supply and output functions. The latter functions model the fixed broadband market operation and estimate the economic impact of fixed broadband while controlling for the reverse effects. The demand function links fixed broadband penetration to the average consumption propensity of individuals proxied by GDP per capita, the cost of a basic fixed broadband service (price of a monthly subscription), the percent of individuals that fulfill secondary education, and the percent of the population residing in densely populated urban areas. The supply function links the aggregate fixed broadband revenue to the relevant price levels and the GDP per capita. The infrastructure equation links annual change in fixed broadband penetration to the market revenues, used as a proxy of the capital invested in a country during one year.

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[102] Given that the final estimation was made over the total GDP (rather than GDP per capita), impact analysis in this step relied on total GDP CAGR.
[103] Given that the final estimation was made over the total GDP (rather than GDP per capita), impact analysis in this step relied on total GDP CAGR.
[104] Given that the final estimation was made over the total GDP (rather than GDP per capita), impact analysis in this step relied on total GDP CAGR.

The econometric specification of the model is as follows:

Aggregate Production function:
$$GDP_{it}=a_1K_{it}+a_2L_{it}+a_3Fix\_Bob\_Pen_{it}+a_4OilPrice_{it}+a_5Shock_{it}+e_{it} \tag{6}$$

Demand function:
$$Fix\_Bob\_Pen_{it}=b_1Rural_{it}+b_2Fixed\_Tel\_Pen_{it}+b_3FBB\_Price_{it}+b_4GDPC_{it}+b_5HHI\_FBB_{it}+e_{it} \tag{7}$$

Supply function:
$$FBB\_Rev_{it}=c_1FBB\_Pr_{it}+c_2GDPC_{it}+c_3HHI\_FBB_{it}+\varepsilon_{3it} \tag{8}$$

Output function:
$$Variation\ in\ FBB\_Pen_{it}= d_1FBB\_Rev_{it}+\varepsilon_{3it} \tag{9}$$

The model found that fixed broadband has affected the economy of Jordan between 2006 and 2014. The annualized average contribution to the Gross Domestic Product is equal to an estimated 0.073 % of GDP growth for every 1% increase of fixed penetration (see Table 29).

Table 29. Jordan: Results of Fixed Broadband Model

```
. reg3 (lgdp1 lfcapital_3 llabedu_1 lfbbusers lnoil primavera2 yr_11-yr_15 ) (lfbbusers lnrural lnfix
> ed lgdpc1 lfbbcost hhi_fbb)     (lrevenuefbb    lgdpc1 lfbbcost hhi_fbb)     (fbbgrowth lrevenuefbb)
>     if yr>2010 | (yr>2009 & qt>3)

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	17	9	.0005318	1.0000	556576.43	0.0000
lfbbusers	17	5	.0122656	0.7766	263522.64	0.0000
lrevenuefbb	17	3	.0282128	0.9341	251.01	0.0000
fbbgrowth	17	1	.0129676	0.0305	0.85	0.3570

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	.5922792	.0046451	127.51	0.000	.583175	.6013834
llabedu_1	-.0225151	.0112689	-2.00	0.046	-.0446017	-.0004285
lfbbusers	.0726106	.0130345	5.57	0.000	.0470635	.0981577
lnoil	.0059123	.0015517	3.81	0.000	.0028711	.0089535
primavera2	-.0000499	.0005943	-0.08	0.933	-.0012148	.0011149
yr_11	.0008911	.0007174	1.24	0.214	-.000515	.0022973
yr_12	(omitted)					
yr_13	-.0006354	.0006766	-0.94	0.348	-.0019614	.0006906
yr_14	.000094	.0010672	0.09	0.929	-.0019781	.0021661
yr_15	-.001171	.0013451	-0.87	0.384	-.0038073	.0014654
_cons	-1.138769	.0443004	-25.71	0.000	-1.225596	-1.051941
lfbbusers						
lnrural	-.7366837	.545923	-1.35	0.177	-1.806673	.3333058
lnfixed	.0254023	.0963031	0.26	0.792	-.1633483	.2141528
lgdpc1	.4204917	.1160644	3.62	0.000	.1930096	.6479738
lfbbcost	.2887615	.0888454	3.25	0.001	.1146277	.4628953
hhi_fbb	-.1113558	.0914274	-1.22	0.223	-.2905501	.0678385
_cons	(omitted)					
lrevenuefbb						
lgdpc1	.5977948	.4081689	1.46	0.143	-.2022015	1.397791
lfbbcost	1.270386	.2257215	5.63	0.000	.8279801	1.712792
hhi_fbb	-.1733384	.2098662	-0.83	0.409	-.584649	.2379722
_cons	9.387208	5.665109	1.66	0.098	-1.716202	20.49062
fbbgrowth						
lrevenuefbb	.0262383	.0284863	0.92	0.357	-.0295938	.0820704
_cons	-.4365963	.4789858	-0.91	0.362	-1.375391	.5021986

```
Endogenous variables:   lgdp1 lfbbusers lrevenuefbb fbbgrowth
Exogenous variables:    lfcapital_3 llabedu_1 lnoil primavera2 yr_11 yr_12
    yr_13 yr_14 yr_15 lnrural lnfixed lgdpc1 lfbbcost hhi_fbb
```

Source: TAS analysis

In addition, the model results confirm the economic spillover of fixed broadband in Jordan. In addition, the structural model yields other interesting findings:

- Fixed broadband prices has positively affected revenues (coefficient: 1.270)
- Competition has not statistically significant effect on fixed broadband penetration
- Incomes seem to affect positively fixed broadband penetration (coefficient: 0.420) and fixed broadband revenues (coefficient: 0.597)
- Oil prices has a positive effect on GDP growth (coefficient: 0.05)

In addition, the model found that fixed broadband has affected the economy of Tunisia between 2005 and 2014. The annualized average contribution to the Gross Domestic Product is equal to an estimated 0.101 % of GDP growth for every 1% increase of fixed broadband penetration (see Table 30).

Table 30. Tunisia: Results of Fixed Broadband Model

Three-stage least-squares regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	37	13	.0081931	0.9890	3585.30	0.0000
lfbbusers	37	5	.1149318	0.9851	2828.02	0.0000
lrevenuefbb	37	3	.2598174	0.9141	401.09	0.0000
fbbgrowth	37	1	.0762928	0.6312	76.05	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	.0274233	.0417489	0.66	0.511	-.0544031	.1092496
llabedu_1	-.7114725	.2993209	-2.38	0.017	-1.298131	-.1248143
lfbbusers	.1013892	.0234446	4.32	0.000	.0554386	.1473397
lnoil	-.0020311	.0111004	-0.18	0.855	-.0237875	.0197254
yr_7	-.009757	.0111622	-0.87	0.382	-.0316345	.0121205
yr_8	.0005061	.0188984	0.03	0.979	-.036534	.0375461
yr_9	.0096738	.023094	0.42	0.675	-.0355897	.0549373
yr_10	.0040161	.028021	0.14	0.886	-.050904	.0589363
yr_11	.0174078	.0307853	0.57	0.572	-.0429302	.0777458
yr_12	-.0078756	.0325915	-0.24	0.809	-.0717536	.0560025
yr_13	.0258332	.0329826	0.78	0.433	-.0388115	.0904779
yr_14	.0562481	.0323026	1.74	0.082	-.0070638	.1195599
yr_15	.0827906	.0317604	2.61	0.009	.0205414	.1450398
_cons	11.7643	1.051399	11.19	0.000	9.703598	13.82501
lfbbusers						
lnrural	-92.01957	8.555878	-10.76	0.000	-108.7888	-75.25036
lnfixed	6.294286	.6318014	9.96	0.000	5.055978	7.532594
lgdpc1	5.889652	.9029712	6.52	0.000	4.119861	7.659443
lfbbcost	-.2420463	.2619467	-0.92	0.355	-.7554523	.2713598
hhi_fbb	-.2678582	.2029911	-1.32	0.187	-.6657135	.1299971
_cons	352.4417	24.66657	14.29	0.000	304.0961	400.7873
lrevenuefbb						
lgdpc1	14.51933	1.404453	10.34	0.000	11.76665	17.272
lfbbcost	-1.495357	.3715832	-4.02	0.000	-2.223646	-.7670672
hhi_fbb	-1.10916	.3217764	-3.45	0.001	-1.739831	-.4784903
_cons	123.3708	9.489112	13.00	0.000	104.7724	141.9691
fbbgrowth						
lrevenuefbb	-.1224333	.0140397	-8.72	0.000	-.1499507	-.0949159
_cons	2.054796	.2243884	9.16	0.000	1.615003	2.49459

Endogenous variables: lgdp1 lfbbusers lrevenuefbb fbbgrowth
Exogenous variables: lfcapital_3 llabedu_1 lnoil yr_7 yr_8 yr_9 yr_10 yr_11
    yr_12 yr_13 yr_14 yr_15 lnrural lnfixed lgdpc1 lfbbcost hhi_fbb

Source: TAS analysis

The model results confirm the economic spillover of fixed broadband in Tunisia. In addition, the structural model yields other interesting findings:

- Fixed broadband prices do not have a statistically significant impact on penetration (this is consistent with countries with low penetration, where early adopters are less price sensitive)
- Income levels have a positive impact on fixed broadband penetration (coefficient: 5.889) and on fixed broadband revenues (coefficient: 14.519)
- A complementary effect exist between fixed line telephone penetration and fixed broadband penetration (coefficient: 6.294)

The model also found that fixed broadband has affected the economy of Morocco between 2006 and 2014. The annualized average contribution to the Gross Domestic Product is equal to an estimated 0.084 % of GDP growth for every 1% increase of fixed broadband penetration (see Table 31).

Table 31. Morocco: Results of Fixed Broadband Model

```
. reg3 (lgdp1 lfcapital_3 llabedu_1 lfbbusers  yr_10-yr_15 ) (lfbbusers  lmbbusers lnrural lnfixed lg
> dpc1  lfbbcost hhi_fbb)    (lrevenuefbb    lgdpc1 lfbbcost hhi_fbb)    (fbbgrowth lrevenuefbb) if y
> r>2009

Three-stage least-squares regression
```

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
lgdp1	20	7	.0053624	0.9913	2372.19	0.0000
lfbbusers	20	6	.0092147	0.9982	12131.17	0.0000
lrevenuefbb	20	3	.0449892	0.6837	54.72	0.0000
fbbgrowth	20	1	.0191042	0.0132	3.33	0.0682

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lgdp1						
lfcapital_3	1.243297	.1633139	7.61	0.000	.923208	1.563387
llabedu_1	-.2071316	.1012369	-2.05	0.041	-.4055522	-.008711
lfbbusers	.0840642	.0425875	1.97	0.048	.0005943	.1675342
yr_10	(omitted)					
yr_11	.0075135	.0184933	0.41	0.685	-.0287328	.0437597
yr_12	.0088832	.016553	0.54	0.592	-.0235601	.0413265
yr_13	-.0110266	.0127643	-0.86	0.388	-.0360442	.013991
yr_14	-.014658	.007098	-2.07	0.039	-.0285698	-.0007462
yr_15	(omitted)					
_cons	-4.517016	.9135615	-4.94	0.000	-6.307564	-2.726468
lfbbusers						
lmbbusers	.0168601	.038111	0.44	0.658	-.0578361	.0915563
lnrural	-5.698085	2.167674	-2.63	0.009	-9.946649	-1.449521
lnfixed	-.718536	.1541008	-4.66	0.000	-1.020568	-.416504
lgdpc1	.6945729	.1592029	4.36	0.000	.382541	1.006605
lfbbcost	-.0765007	.0554237	-1.38	0.167	-.1851291	.0321277
hhi_fbb	-1.34772	.2932718	-4.60	0.000	-1.922522	-.7729177
_cons	31.2544	6.560955	4.76	0.000	18.39516	44.11363
lrevenuefbb						
lgdpc1	1.568325	.6883007	2.28	0.023	.2192801	2.917369
lfbbcost	-.0146431	.1096959	-0.13	0.894	-.2296432	.200357
hhi_fbb	.0108446	1.011025	0.01	0.991	-1.970729	1.992418
_cons	6.657234	6.516	1.02	0.307	-6.11389	19.42836
fbbgrowth						
lrevenuefbb	.0927377	.050847	1.82	0.068	-.0069206	.192396
_cons	-1.554156	.8702949	-1.79	0.074	-3.259902	.151591

```
Endogenous variables:  lgdp1 lfbbusers lrevenuefbb fbbgrowth
Exogenous variables:   lfcapital_3 llabedu_1 yr_10 yr_11 yr_12 yr_13 yr_14
    yr_15 lmbbusers lnrural lnfixed lgdpc1 lfbbcost hhi_fbb
```

Source: TAS analysis

The model results confirm the economic spillover of fixed broadband in Morocco. In addition, the structural model yields other interesting findings:

- Fixed broadband prices has not a significant impact in prices, nor in revenues
- Competition has positively affected fixed broadband penetration (a negative relation between HHI and penetration of -1.347)
- Incomes seem to affect positively fixed broadband penetration (coefficient: 0.694) and fixed broadband revenues (coefficient: 1.568)

The coefficient of fixed broadband GDP impact estimated by the structural model above can be compared with those derived from applying similar models to other countries (see Figure 7).

Figure 7: Comparative Fixed Broadband Economic Impact vs. Fixed Broadband Penetration
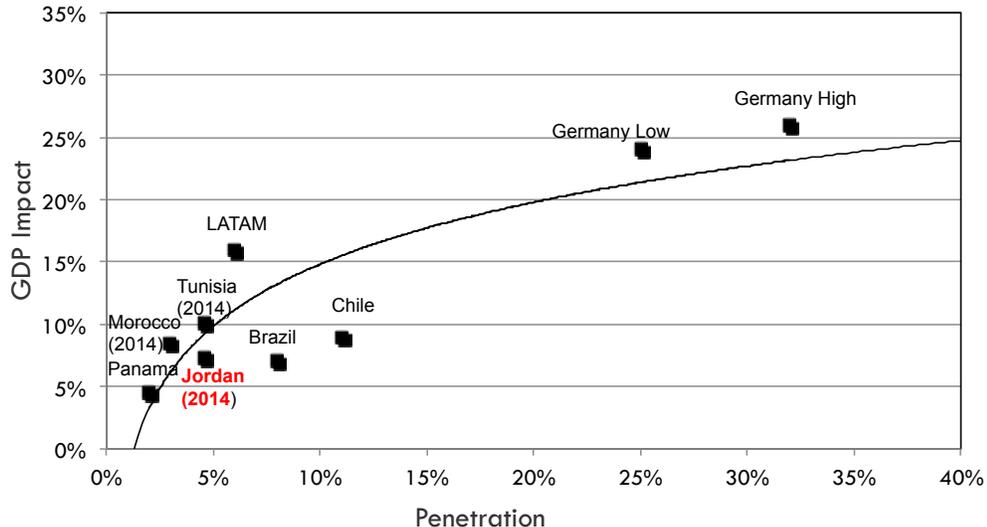
Source: TAS analysis

Considering Jordan's relatively low fixed broadband penetration, it is not surprising that the economic impact of the technology is fairly limited (0.073 % of GDP growth for every 1% increase of mobile penetration) compared to the estimates calculated for industrialized countries (such as Germany with an impact coefficient of 0.23%). On the other hand, as shown in figure 14, Jordan's coefficient is fairly consistent with those estimated for other MENA countries and other emerging nations. Considering that mobile broadband is assuming the preeminent role in meeting Jordan's demand, it is doubtful that the GDP impact of fixed broadband will ever reach higher values.

The actual contribution of fixed broadband was calculated by multiplying the compound annual growth rate of fixed broadband penetration between 4Q2006 and 4Q2014 by the

coefficient of economic impact derived from the econometric model presented in Table 11 (Formula 6):

CAGR = (Fixed broadband penetration 4Q2014 (26.87%)-Fixed broadband penetration 1Q2001 (4.69%)) ^ (1/8 years)-1   (5)

The CAGR for fixed broadband in Jordan for the period 4Q2006 - 4Q2014 is 24.39%.

Impact of fixed broadband on GDP (4Q2006-4Q2014)= CAGR (24.39%)*Coefficient of Impact (0.073)   (6)

(see table 32).

Table 32. MENA Countries: Calculation of Fixed Broadband Indirect Contribution to GDP

Item	Factor	Jordan	Tunisia	Morocco	Source and / or estimation formula
1	Annual contribution of fixed broadband to GDP growth (for a 10% increase in additional penetration)	0.73%	1.01 %	0.84 %	Coefficient resulting from structural model
2	Fixed broadband penetration 4Q2014	26.87%	13.91 %	14.15 %	ANRT
3	Fixed broadband penetration 4Q2006	4.69%	10.97 % (*)	6.25 %	UIT
4	Compound Annual Growth Rate (CAGR) of fixed broadband penetration	24.39 %	4.87 % (**)	10.76 %	(Fixed broadband penetration 4Q2014/1Q2006) ^(1/8 years)-1
5	Annual impact of fixed broadband on GDP	1.77 %	0.49 %	0.90 %	(Annual impact)/10 * (CAGR fixed broadband penetration)
6	CAGR GDP (2006-2014)	11.42 %	2.17 % (***)	6.57 %	(GDP 4Q2014/ GDP 4Q2006)^(1/8 years)-1
7	Percent contribution of fixed broadband to GDP growth	15.50 %	22.75 % (****)	13.77 %	Annual impact of fixed broadband on GDP / CAGR GDP (2006-2014)
8	Incremental GDP growth (2014-2006)	US$ 20,708 M	US$ 4,939 M (*****)	US$ 43,561 M	GDP 4Q2014 - GDP 4Q2006
9	Total impact of fixed broadband on incremental GDP growth	US$ 3,211 M	US$ 1,124 M (*******)	US$ 6,000 M	Incremental GDP (4Q2014/1Q2006) * % contribution of fixed broadband to GDP growth
10	Annual impact of fixed broadband on GDP	US$ 401 M	US$ 225 M (********)	US$ 750 M	Total impact / 8 years

(*) In Tunisia, the starting point is 4Q2009

(**) In Tunisia, (Fixed broadband penetration 4Q2014/4Q2009) ^ (1/5 years)-1

(***) In Tunisia, (GDP 4Q2014/ GDP 4Q2009)^(1/5 years)-1

(****) Annual impact of fixed broadband on GDP / CAGR GDP (2009-2014)

(*****) In Tunisia, GDP 4Q2014 - GDP 4Q2009

(******) In Tunisia, Incremental GDP (4Q2014/4Q2009) * % contribution of fixed broadband to GDP growth

(*******)Total impact / 5 years

Source: Telecom Advisory Services analysis

In the case of Jordan, the annual contribution on GDP from fixed broadband amounts to 1.77% of GDP. Based on the difference between 2006 GDP of US$ 15,057 million and 2014 GDP of US$ 35,765 million, which yields a CAGR of 11.42%[105], the indirect annual contribution of fixed broadband to the GDP of Jordan amounts to US$ 401 million.

For Tunisian fixed broadband, the annual contribution on GDP from fixed broadband amounts to 0.49% of GDP. Based on the difference between 2009 GDP of US$ 43,614 million and 2014 GDP of US$ 48,553 million, which yields a CAGR of 2.17%[106], the indirect annual contribution of fixed broadband to the GDP of Tunisia amounts to US$ 225 million.

Finally, in the case of Morocco, the annual contribution on GDP from fixed broadband amounts to 0.90% of GDP. Based on the difference between 2006 GDP of US$ 65,640 million and 2014 GDP of US$ 109,201 million, which yields a CAGR of 6.57%[107], the indirect annual contribution of fixed broadband to the GDP of Morocco amounts to US$ 750 million.

5.3 Total contribution of the telecommunications industry to MENA countries' GDP

When considering the aggregate industry revenues and the spill-over indirect effects on the rest of the MENA countries' economies, telecommunications have a total GDP impact ranging from of 6.43 % in Jordan to 4.72% in the case of Tunisia (see table 33).

Table 33. MENA Countries: Direct and indirect contribution of telecommunications to the economy (2014)

		Jordan		Tunisia		Morocco	
		Million US$	In % of GDP	Million US$	In % of GDP	Million US$	In % of GDP
Industry Gross revenues	Fixed telephony	$ 526	1.47 %	$ 329	0.68 %	$ 27	0.03 %
	Fixed broadband	$ 79	0.22 %	$ 35	0.07 %	$ 122	0.11 %
	Mobile telecommunications	$ 918	2.57 %	$ 1,181	2.43 %	$ 3,923	3.59 %
	Total	$ 1,523	4.26 %	$ 1,545	3.18 %	$ 4,072	3.73 %
Indirect contribution	Mobile telecommunications	$ 375	1.05 %	$ 524	1.08 %	$ 1,597	1.46 %
	Fixed broadband	$ 401	1.12 %	$ 225	0.46 %	$ 750	0.69 %
	Subtotal	$ 776	2.17 %	$ 749	1.54 %	$ 2,347	2.15 %
Total		$ 2,299	6.43 %	$ 2,294	4.72 %	$ 6,419	5.88%
Country GDP		$ 35,765	100 %	$ 48,533	100 %	$ 109,201	100 %

Source: Telecom Advisory Services analysis

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[105] Given that the final estimation was made over the total GDP (rather than GDP per capita), impact analysis in this step relied on total GDP CAGR.
[106] Given that the final estimation was made over the total GDP (rather than GDP per capita), impact analysis in this step relied on total GDP CAGR.
[107] Given that the final estimation was made over the total GDP (rather than GDP per capita), impact analysis in this step relied on total GDP CAGR.

The strong contribution of telecommunications to the MENA countries' economies is a function of two factors:

1. The sector dynamism: the telecommunications sector is growing, generating in turn direct and indirect jobs. In fact, the operators trigger a significant number of local suppliers, distributions agents, and providers of various services, which enhance the local value added to the economy.

2. The positive externalities (« Spill-over effects »): telecommunications networks and services result in a more efficient functioning of the economy particularly in terms of:
   - Productivity gains in existing sectors (such as tourism, exports, manufacturing) as well as social services, such as education and public administration;
   - Innovation incentives, leading to the creation of new businesses in the digital economy (applications, software platforms, local content);
   - Integration of isolated regions, leading to further development of economic activities;
   - Better coordination among economic agents through improved knowledge of inputs market prices (agriculture), better coordination between economic agents resulting in low transaction costs, enhanced ability to negotiate selling prices; inventory management and delivery tracking;
   - Improvement and extension of domestic economic exchanges, as well as at the regional and global scale.

5. Policy Implications to facilitate telecommunication adoption and welfare

Ultimately, this study finds that the overarching consensus – that ICT adoption encourages economic growth – holds true for the MENA countries under study, where ICT has impacted the economy and employment while allowing the country to benefit from many of its positive externalities. In terms of GDP impact, the results are fairly conclusive (see table 34).

Table 34. MENA Countries: Telecommunications Direct and Indirect Contribution to GDP (in US$ millions unless indicated) (2014)

	Jordan	Tunisia	Morocco	Total
National GDP (2012)	US$ 35,765	US$ 48,533	US$ 109,201	US$ 193,499
Direct Telecommunications Impact	US$ 1,523	US$ 1,545	US$ 4,072	US$ 7,140
Indirect Telecommunications Impact	US$ 776	US$ 749	US$ 2,347	US$ 3,872
Total Telecommunications Impact	US$ 2,299	US$ 2,294	US$ 6,419	US$ 11,012
Percent of National GDP	6.43 %	4.72 %	5.88%	5.69 %

Source: TAS analysis

This study concluded that increased adoption of mobile and broadband technology encourages economic activity by enhancing market access, fostering financial inclusion, delivering training resources, and even developing new sectors. Given the positive

relationship between ICT and economic growth, these countries must promote policies that foster adoption while also increasing regulatory stability and promoting local content and services development.

In addition, the study was able to formalize the strength of telecommunications contribution vis-à-vis the penetration of technology (see figure 8).

Figure 8. Comparative Impact of Telecommunications on GDP growth
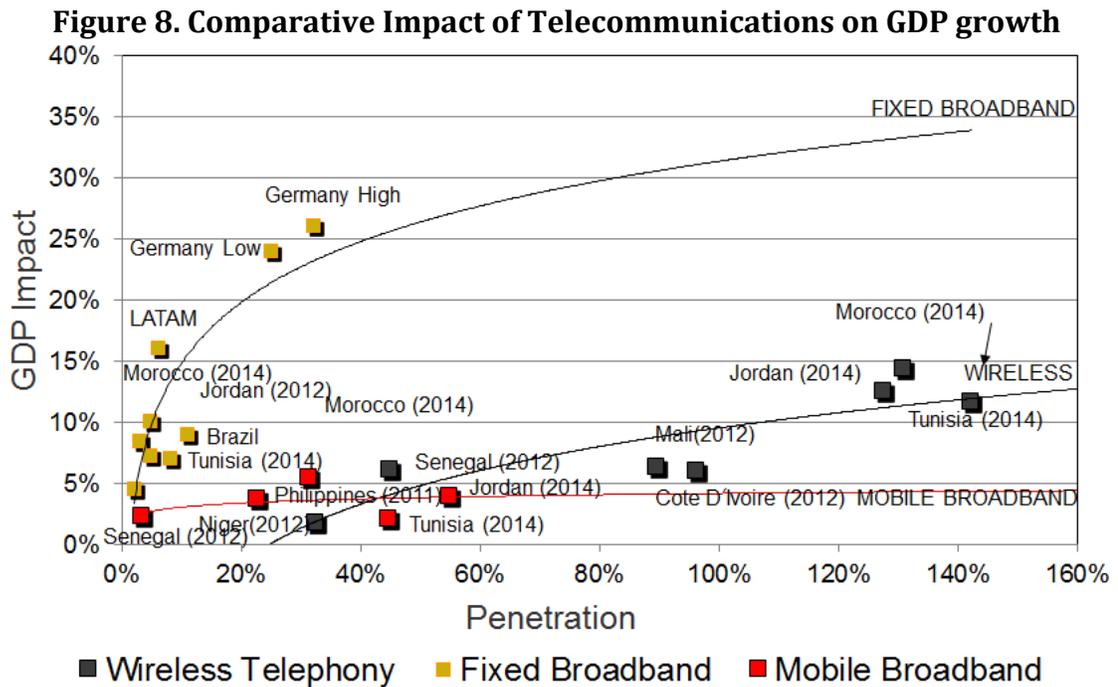
Source: Telecom Advisory Services analysis

Figure 8 depicts three types of relationships between technology penetration and impact on GDP growth. By combining the study results on AMEA with those of prior studies conducted by the authors, the strength of the economic impact appears to be different. First, while all three technologies (fixed broadband, wireless broadband and broadband) exercise an increasing impact on GDP growth with higher penetration, the three of them show a diminishing return effect. In other words, at a certain point of adoption of each technology, the economic impact appears to diminish (a point of diminishing returns). Second, the strength of economic impact appears to vary by technology. The highest impact appears to be linked to fixed broadband (e.g. stronger GDP growth linked to comparable penetration). However, considering that in emerging countries, mobile broadband is a substitute of fixed technology, one.

This underscores three public policy implications. First and foremost, policy makers must create a high level of regulatory certainty in order to stimulate the capital expenditures that will lead to further deployment of mobile broadband networks, which provide the infrastructure to offer mobile broadband services. Second, while market competition has encouraged a decline in prices and increased operator investment in the sector, it is critical to consider that excessive industry fragmentation is detrimental to sustainability and

innovation levels. As a result, consumers and the overall sector could experience frictional costs. Third, to stimulate technology adoption, the government should promote the local development of applications, services, and content.

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APPENDIX A: Data Sources

Data	Sources
Fixed Line subscribers	ITU
Mobile subscribers	GSMA Intelligence
Fixed broadband subscriptions	ITU
GDP	IMF
Total Wireless Service Revenues	GSMA Intelligence
HHI Mobile	GSMA Intelligence
GDP per capita	IMD
Population	GSMA Intelligence
Fixed (wired)-broadband monthly subscription charge, in USD	ITU
Gross fixed capital formation (current US$)	World Bank
Gross fixed capital formation (constant 2005 US$)	World Bank
Gross fixed capital formation (% of GDP)	World Bank
Labor force, total	World Bank
School enrollment, tertiary (% gross)	World Bank
Total Mobile Connections/Population	GSMA Intelligence
100 - "Rural population (% of total population)"	World Bank
Mobile ARPU	GSMA Intelligence
Households	ITU
HHI Mobile Broadband	GSMA Intelligence
Revenue Fixed Broadband	ITU & Pyramid
HHI Fixed Broadband	OVUM
Price Fixed Broadband	ITU & Pyramid
Revenue Mobile Broadband	ITU & Pyramid
ARPU Mobile Broadband	ITU & Pyramid
Oil Price	St. Louis FED