

The economic impact of Telecommunications in the Republic of Cameroon¹

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Abstract

The purpose of this paper is to analyze the economic impact of telecommunications in the Republic of Cameroon. The empirical analysis conducted suggests that the sector generates a significant direct and indirect economic impact, contributing to 3.74% of the country's 2018 GDP. From a direct effect standpoint, the Cameroon telecommunications carriers generated US\$ 970 million in revenues in 2018 which represented 2.51% of the country's GDP. Beyond the direct effects, the telecommunications industry has indirectly contributed US\$ 476 million on average per year to the whole economy since 2012 (1.23% of the 2018 GDP). This contribution is driven by mobile services (voice and data), but does not consider fixed broadband, which has no economic impact, due to the limited number of subscribers. Sectors mostly impacted by telecommunications were found to be business services (33% of the indirect economic impact), trade (22%), and minerals (8%). Given the economic importance of telecommunications, public policies and regulatory frameworks need to be defined to maximize investment in network deployment, particularly in mobile broadband.

JEL classification: L96, O33, O47

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1. Introduction

The purpose of this paper is to analyze the economic impact of the telecommunications sector in the Republic of Cameroon. Driven by wireless technology, the country's telecommunications services have expanded in recent years and are now being used by a large portion of the population (the country reached 51% mobile unique subscribers' penetration in 2019²), reflecting a fairly developed market expected to generate a positive impact on the economy. To estimate the sector contribution, this study compiled statistics of its direct effect from National Accounts, constructed a structural model to calculate the indirect impact, and built an input/output table to determine the industries mostly benefitting from telecommunications.

To provide a context for its approach, the study first reviews the research literature conducted to assess the economic impact of telecommunications, introducing the recent empirical work (chapter 2). Chapter 3 provides a descriptive analysis of the country's economy and the recent evolution trends of the telecommunications sector. Telecommunications' direct and indirect economic contributions to Cameroon's economy follow (chapter 4), along with a discussion of the study's methodology and findings. Finally, conclusions and policy implications are derived these findings (chapter 5).

2. Research Review

In the past decades, several studies have been conducted to assess the economic impact of telecommunications, confirming positive effects on GDP growth and, in some cases, on employment and productivity (Hardy, 1980; Karner and Onyeji, 2007; Jensen, 2007; Katz et al., 2008; Katz, 2011; Katz et al., 2009; Katz et al, 2012, Arvin and Pradhan, 2014).

While most single country research tends to focus on advanced economies, more recent studies, propelled by data availability, have been able to offer evidence of these benefits in the case of emerging countries as well. Mobile telephony, particularly, has acquired a growing role in several low-income countries, by addressing the lack of traditional fixed-line services and generating significant economic effects. As mobile networks become a permanent fixture of the digital infrastructure, so, too, does their effect on the market and the economy.

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,

² Source: GSMA Intelligence

consumer welfare improvements (Aker, 2008). Along those lines, rural Ugandan banana farmers producing perishable crops benefitted as the costs of crop marketing decreased because of enhanced mobile coverage (Muto, 2008).

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

In some instances, the introduction of mobile networks can result in the creation of employment. When a region of South Africa benefitted from enhanced wireless network, employment significantly increased (Klonner and Nolen, 2010); in Malawi, female labor participation increased as a result of a similar effect (Batziillis et al., 2010). On a related note, the mobile applications that assist with the job search and application process were identified as being 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 listed online, where only those citizens with digital literacy skills and Internet access can apply for them.

In particular, 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) found 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. A similar effect was identified by Katz and Callorda (2018).

Like mobile voice services, broadband can also affect economic growth, at several levels. First, the deployment of broadband technology across business enterprises improves productivity by facilitating the adoption of more efficient business processes (e.g., marketing, inventory optimization, and streamlining of supply chains). Second, extensive deployment of broadband accelerates innovation by introducing new consumer applications and services (e.g., new forms of commerce and financial intermediation). Third, broadband leads to a more efficient functional deployment of enterprises by maximizing their reach to labor pools, access to raw materials, and consumers (e.g., outsourcing of services, virtual call centers). In recent years, the explosive growth of mobile broadband allowed for the study of its specific economic contribution. For instance, Katz and Koutroumpis (2013) estimated that, in the case of Senegal, a structured

model like the one used in this study indicated that every 1% increase in mobile broadband penetration yielded 0.022% growth in GDP.

In sum, multiple studies conclude that mobile networks and broadband access have positive economic effects. This study will provide additional insights regarding the economic impact of telecommunications on the economy of Cameroon.

3. Descriptive analysis

Country overview

Cameroon has been classified as a “low-middle income” economy by the World Bank. The country has been growing at an average 4% rate since 2016. Due to the COVID-19 worldwide crises and the fall in oil prices, the country’s economy is projected to contract this year (-1.2% forecasted growth), before recovering to 4% growth in 2021, according to International Monetary Fund estimates.³

Cameroon is an oil-producing country since 1977, since that industry emerged as a key sector driving the country’s economic performance in recent decades. Recent growth rates have also been driven by an increase in natural gas production and sustained momentum in the construction, industry, housing, and services sectors.⁴

With a total population of 25 million - 43% of which live in rural areas -, the country reports a low unemployment rate of 3.3%⁵. Cameroon is the largest economy in the Central African Economic and Monetary Community (CEMAC), a region experiencing a difficult economic situation due to the recent decline in oil prices. Current account balances has been negative for some time, and the country had to put fiscal adjustment measures in place to adjust to the terms of trade shock and restore macro-stability and confidence in the common currency.⁶

Since 2012, Cameroon’s economic growth has been outperforming that of the Sub-Saharan African region (see Figure 1).

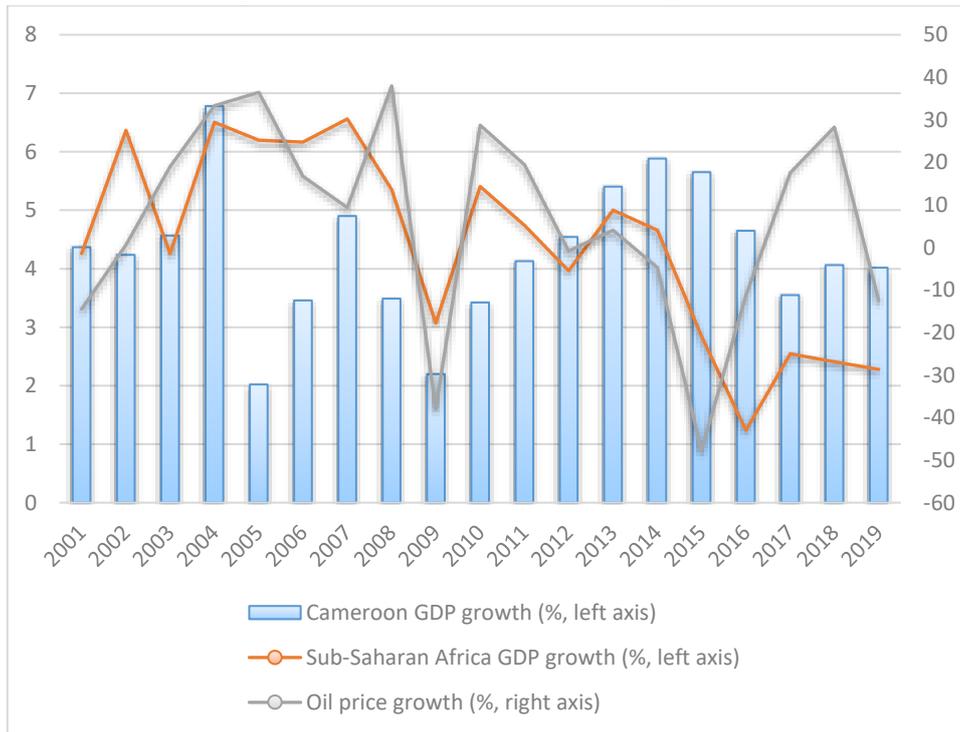
³ Source: International Monetary Fund, World Economic Outlook Database, April 2020

⁴ Source: World Bank - Cameroon overview

⁵ Source: Statista

⁶ Source: World Bank - Cameroon overview

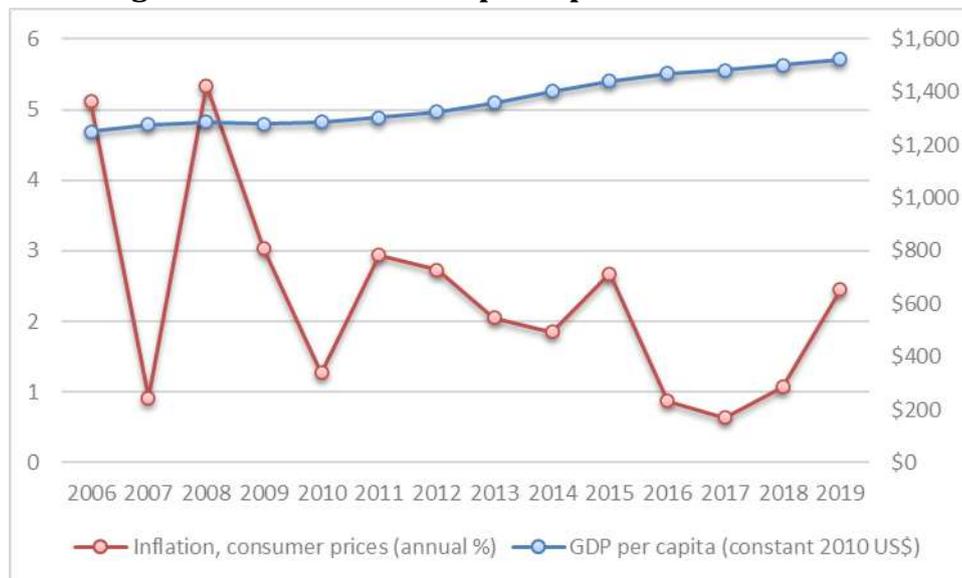
Figure 1. Cameroon: economic growth



Source: own elaboration from World Bank and Federal Reserve St. Louis data

Real GDP per capita exhibited continuous growth since 2006, while inflation has been under control in the country for several years, below the 6% threshold (Figure 2).

Figure 2. Cameroon: GDP per capita and Inflation



Source: own elaboration from World Bank Development Indicators

The fiscal balance of the government has been in deficit in recent years, although debt remains at a moderate level, with a public debt-to-GDP ratio falling from 35.7% in 2017

to 34% in 2018⁷. Increasing productivity and unlocking the potential of its private sector remain the country's key challenges lying ahead.⁸

Despite the reported low unemployment rate, the country faces big social challenges. According to United Nations, 45.3% of the population lives in “multidimensional poverty”⁹. On the other hand, poverty is increasingly concentrated, with 56% of the poor living in the northern regions. Life expectancy at birth is 58 years, while adult literacy rate is 77%.¹⁰ In 2019, Cameroon was ranked in 150 out of 189 countries in the UN Human Development Index placing it in the “medium human development” category.

The telecommunications sector

In 2018, the telecommunications industry of Cameroon reached revenues representing 2.51% of the country's GDP¹¹, providing evidence of the relevance of this sector for the country's economy.

With more than 19.2 million wireless subscriptions and 13.1 million unique mobile subscribers by the end of 2019, mobile penetration in the country has reached 74% in terms of subscriptions and 51% of potential unique subscribers¹². The country's mobile penetration rate is somewhat behind the regional average of Sub-Saharan African countries (82.4% by 2018)¹³. In addition, by the end of 2019 there were 10,353,992 internet subscriptions¹⁴, which represents a mobile broadband penetration of 40%. Figure 3 depicts the recent evolution in terms of subscriptions for the different telecommunications services.

As indicated in Figure 3, the Cameroon telecommunications environment is essentially based on wireless technology. The International Telecommunications Union (ITU) reported 17,987 fixed broadband subscriptions by 2018, which result in only 0.4% of household penetration. Therefore, the analysis of the economic impact of telecommunications must be conducted exclusively in terms of wireless technology adoption.

⁷ Source: Trading Economics

⁸ Source: World Bank - Cameroon overview

⁹ Concept introduced by the United Nations to measure how people experience poverty in multiple and simultaneous ways: health, education, and standard of living.

¹⁰ Source: World Health Organization and UNESCO

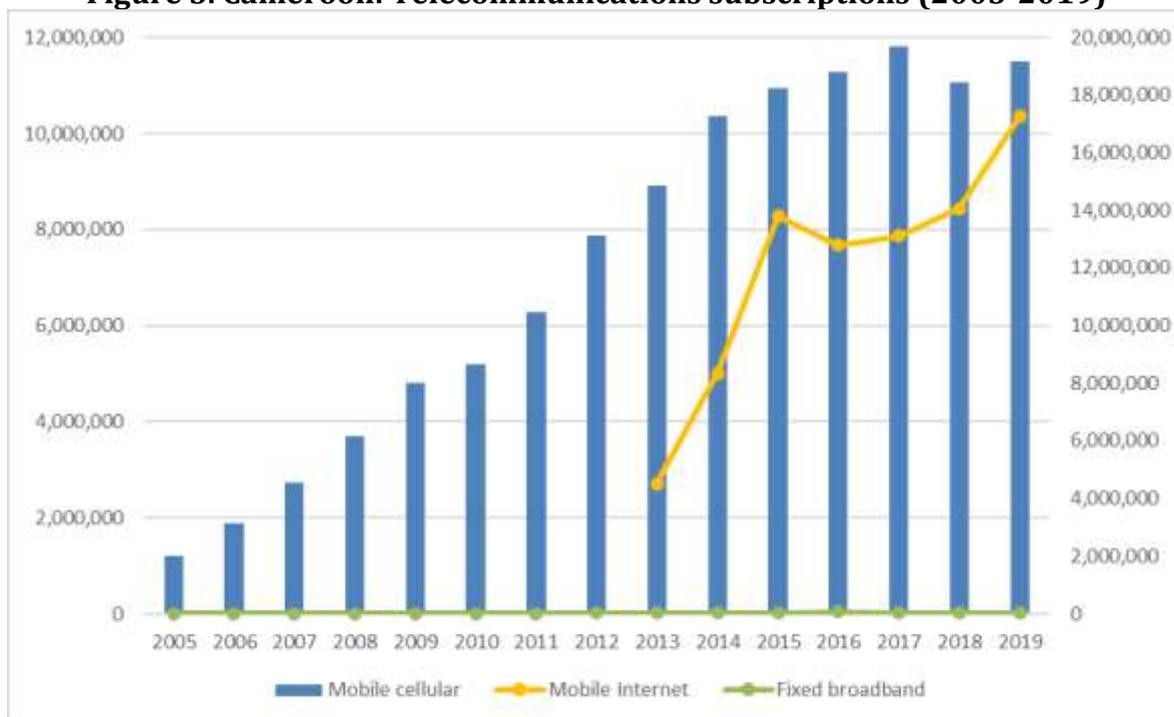
¹¹ Source: ART (2019) and World Bank World Development Indicators.

¹² Source: Agence de Régulation des Télécommunications (ART, 2019) and GSMA Intelligence

¹³ Source: World Bank World Development Indicators

¹⁴ Source: ART (2019)

Figure 3. Cameroon: Telecommunications subscriptions (2005-2019)



Sources: own elaboration from ART and ITU for data 2005-2018. Data for 2019 extrapolated using GSMA Intelligence projected growth (mobile cellular and mobile internet) and CAGR of the previous 4 years (fixed broadband).

4. Results of the empirical estimates

The contribution of telecommunication services to economic growth is driven by the sector internal dynamics (such as the investments linked to the deployment of networks and services) and the positive externalities derived from individual consumer and enterprise use of services (*spill-over effects*). By allowing a more efficient functioning of the economy, telecommunications networks and services contribute to overall value creation.

As stated above, the direct effect of the sector in the economy can be approximated by its weight in the country's GDP (the industry gross revenues in 2018 where US\$ 970 million¹⁵, which represent a 2.51% GDP). On the other hand, the analysis of *spill-over* effects (also called indirect) of mobile telecommunications on the economy is measured through a structural econometric model, composed of an aggregated production function, a demand function, a supply function, and an infrastructure function; defined as follows:

¹⁵ Source: ART (2019)

- Aggregate production function: $GDP_{it}=a_1K_{it}+a_2Labor_{it}+a_3Mob_Pen_{it}+ a_4Shock_{it}+\epsilon_{1it}$
- Demand function: $Mob_Pen_{it}=b_1Rural_{it}+b_2GDPp_{cit}+b_3Mob_Price_{it}+ b_4HHI_{it}+\epsilon_{2it}$
- Supply function: $Revenue_{it}=c_1MobPr_{it}+c_2GDPp_{cit}+c_3HHI_{it}+\epsilon_{3it}$
- Infrastructure function: $\Delta Mob_Pen_{it}=d_1Revenue_{it}+\epsilon_{4it}$

The production function models the impact on GDP from mobile penetration (measured in terms of unique subscribers), with gross capital formation, labor and a “shock” control variable to capture economic cycle variations affecting the country. In this case, the control variable is proxied by the international oil price, underlining the importance of this factor for the country’s economy. The definition and source for the variables used is provided in Table 1.

Table 1. Variables Description and Source

Item	Variable	Source	Comments
1	GDP	World Bank World Development Indicators and International Monetary Fund	Series 2004-2018 from World Bank. Data extrapolated to 2019 with IMF forecasted growth rate. Data converted to quarterly frequency by assuming constant CAGR within each year.
2	K (Gross Fixed Capital Formation)	National Institute Statistics of Cameroon and World Bank World Development Indicators	From the National Institute of Statistics was obtained the GFCF as percentage of GDP (quarterly). When data no available, annual average from World Bank was used.
3	Labor	Penn World Tables	Data till 2018. Extrapolated to 2019 assuming same CAGR from the period covered by the sample. Data converted to quarterly frequency.
4	Mobile unique subscribers'	GSMA Intelligence	Total mobile unique subscribers'
5	Mobile Broadband unique subscribers'	GSMA Intelligence	Total mobile broadband unique subscribers'
6	Fixed-telephone subscriptions	International Telecommunications Union	Data till 2018. Extrapolated to 2019 assuming same CAGR from the period covered by the sample. Data converted to quarterly frequency.
7	Population	World Bank World Development Indicators	Data till 2018. Extrapolated to 2019 assuming same CAGR from the period covered by the sample. Data converted to quarterly frequency.
8	Households	International Telecommunications Union	Data till 2017. Extrapolated to 2019 assuming same CAGR from the period covered by the sample. Data converted to quarterly frequency.
9	Rural population	World Bank World Development Indicators	Data till 2018. Extrapolated to 2019 assuming same CAGR from the period covered by the sample. Data converted to quarterly frequency.
10	GDP per capita	World Bank World Development Indicators and International Monetary Fund	(1)/(7)
11	ARPU (to proxy mobile price)	GSMA Intelligence	Average revenue per connection
12	HHI Mobile	GSMA Intelligence	Industrial concentration index for overall mobile services
13	HHI 3G	GSMA Intelligence	Built with 3G market share data from GSMA Intelligence
14	Mobile Revenue	GSMA Intelligence	(4)*(11)
15	Oil price	Federal Reserve Bank St. Louis	Quarterly average oil price
16	Mobile Broadband Price	Christoph & Allison and ITU	Price of a mobile 1GB plan. Data converted to quarterly frequency and extrapolated to missing periods.

Results for the econometric estimations of the structural model are provided in Table 2.

Table 2. Econometric impact of mobile telecommunications

	[I]	[II]
Aggregate production function	Log(GDP)	Log(GDP)
Log (Mobile unique subscriber penetration)	0.243* [0.135]	
Log (Mobile BB unique subscriber penetration)		0.126* [0.068]
Log (Gross Fixed Capital Formation)	0.256** [0.104]	0.202* [0.108]
Log (Labor)	0.983*** [0.279]	0.798** [0.380]
Log (Oil price)	0.177*** [0.039]	0.190*** [0.041]
Demand function	Log(Mobile unique subscriber penetration)	Log(Mobile BB unique subscriber penetration)
Log (Rural Population)	-2.152*** [0.802]	-4.959 [3.687]
Log (GDP per capita)	0.123 [0.092]	0.513 [0.360]
Log (Mobile ARPU)	-0.723*** [0.065]	
Log (Mobile BB price)		-0.189 [0.121]
HHI Mobile	0.000 [0.000]	
HHI 3G		-0.000*** [0.000]
Supply function	Log(Mobile Revenue)	Log(Mobile BB Revenue)
Log(GDP per capita)	-0.141 [0.112]	-1.412*** [0.519]
Log(Mobile ARPU)	0.287** [0.126]	
Log(Mobile BB price)		0.732*** [0.194]
HHI Mobile	0.000*** [0.000]	
HHI 3G		0.000 [0.000]
Infrastructure function	Mobile unique subscriber adoption growth	Mobile BB unique subscriber adoption growth
Log(Mobile Revenue)	0.003 [0.005]	
Log(Mobile BB Revenue)		0.000 [0.001]
Observations	32	32
Quarter Fixed Effects	Yes	Yes
Years	2012-2019	2012-2019
R-Squared first equation	0.91	0.91

Note: ***, **, * significant at 1%, 5% and 10% critical value, respectively.

Source: prepared by the authors

Column [I] reports the estimates for mobile services for the period 2012-2019, while column [II] provides the results for the specific case of mobile broadband for the same

years¹⁶. According to the econometric model, a 10% increase in unique mobile subscriber penetration yields 2.43% of GDP growth (column [I] of Table 2). The estimation of the contribution of mobile broadband to GDP growth is reported in the column [II] of Table 2, indicating that an increase of 10% of mobile Internet penetration in Cameroon yielded a GDP increase of 1.26%. This result is consistent with that reported in column [I] based on the overall impact of mobile telecommunications, which includes the effects from mobile broadband.

Based on the coefficient reported in column [I] of Table 2, mobile telecommunications have contributed annually an average of US\$ 476 million to Cameroon's economic growth per year between 2012 and 2019 (see Table 3 for full estimation calculus).

Table 3. Mobile telecommunications contribution to Cameroon's economic growth 2012-2019¹⁷

Item	Factor	Value	Source and / or estimation formula
1	Annual contribution of unique mobile subscriber's penetration to GDP growth (for a 10% increase in additional penetration). Includes mobile broadband.	2.43%	Coefficient resulting from structural model
2	Unique mobile subscriber penetration, 4Q 2019	50.53%	GSMA Intelligence
3	Unique mobile subscriber penetration, 4Q 2012	34.06%	GSMA Intelligence
4	Compound Annual Growth Rate (CAGR) of mobile unique subscribers' penetration	5.80%	$(\text{Unique mobile subscribers' penetration } 2019/2012)^{\wedge} (1/7 \text{ years})-1$
5	Annual impact of mobile telecommunications on GDP	1.41%	$(\text{Annual impact}/10) * (\text{CAGR Unique mobile subscribers' penetration})$
6	CAGR GDP (2012-2019)	4.95%	$(\text{GDP } 2019/\text{GDP } 2012)^{\wedge} (1/7 \text{ years})-1$
7	Percent contribution of mobile telecommunications to GDP growth	28.47%	$\text{Annual impact of mobile telecommunications on GDP} / \text{CAGR GDP (2012-2019)}$
8	Incremental GDP growth (2019/2012)	US\$ 11,719 M	$\text{GDP } 2019 - \text{GDP } 2012$
9	Total impact of mobile telecommunications on incremental GDP growth	US\$ 3,336 M	$\text{Incremental GDP (2019/2012)} * \% \text{ contribution of mobile telecommunications to GDP growth}$
10	Annual impact of mobile telecommunications on GDP	US\$ 476 M	$\text{Total impact} / 7 \text{ years}$

Source: prepared by the authors

As indicated in Table 3, the indirect impact from wireless telecommunications (including voice and data) to the Cameroon economy amounts to US\$ 476 million. This amount was

¹⁶ As indicated above, we will not perform an analysis of fixed broadband impact due to its penetration level being marginal in Cameroon.

¹⁷ This impact coefficient includes mobile broadband as well.

allocated by industry sector by relying on an input/output matrix developed for Cameroon. The I/O matrix was developed from the Global Trade Analysis Project Database (GTAP) calculated for the year 2011. According to Cameroon's input/output matrix, this amount would have a downstream impact in the following sectors (see Table 4).

Table 4. Sector impact on Cameroon's GDP increase in telecommunications output

Sector	Percentage of the impact	Sector weight on GDP (*)	Amount (US\$ million)	Amount (% GDP)
Agriculture, mining and food processing	5.06%	33.02%	US\$ 24.09	0.06%
Textiles and apparel	0.83%	1.77%	US\$ 3.95	0.01%
Wood, paper, petroleum, rubber and plastic products	7.20%	6.16%	US\$ 34.27	0.09%
Mineral products	8.43%	1.44%	US\$ 40.13	0.10%
Metal products	14.61%	1.60%	US\$ 69.54	0.18%
Electricity, gas and water	3.85%	1.01%	US\$ 18.33	0.05%
Construction	0.24%	4.75%	US\$ 1.14	0.00%
Trade	22.28%	21.04%	US\$ 106.05	0.27%
Transportation	3.07%	6.42%	US\$ 14.61	0.04%
Financial services	1.26%	0.69%	US\$ 6.00	0.02%
Business services	32.92%	8.94%	US\$ 156.70	0.41%
Other services	0.26%	13.18%	US\$ 1.24	0.00%
Total	100%	100%	US\$ 476	1.23%

(*) Excluding communication sector

Source: prepared by the authors; Global Trade Analysis Project Database (GTAP)

As the data on Table 4 indicates, the most important downstream effects of telecommunications on the Cameroon GDP are concentrated in the business services sector (32.92% of the downstream effect). In addition, significant spillovers can be detected in trade (22.28%), metal products (14.61%), and mineral products sector (8.43%).

5. Conclusions

In summary, mobile telecommunications represent 3.74% of the Republic of Cameroon 2018 GDP¹⁸, broken down in direct and indirect effects as depicted in Table 5.

¹⁸ We prefer to measure the economic contribution to GDP in 2018 (rather than 2019) as this was the last year that the ART reported official data on revenues.

Table 5. Direct and indirect contribution of mobile telecommunications to Cameroon's economic growth

Indicator	Million US\$ (2018)	As % of GDP
Gross revenues of telecommunications operators (2018)	US\$ 970	2.51%
Indirect contribution (spill-over) of mobile telecommunications (includes mobile broadband)	US\$ 476	1.23%
Total impact of mobile telecommunications on Cameroon's 2018 GDP	US\$ 1,446	3.74%

Source: prepared by the authors

These estimates are consistent with those registered in an input/output matrix developed for Cameroon as shown above. According to Table 5, the indirect to direct multiplier is 1.49, while the multiplier for the telecommunications sector according to the input/output matrix is 1.38.

The strong contribution of telecommunications to Cameroon's economy is a function of two factors: (i) the dynamism in terms of the sector growth, which in turn triggers a significant number of local suppliers, distributions agents, and providers of various services; and (ii) the positive externalities or *spill-over* effects, by which telecommunications networks and services result in a more efficient functioning of the economy. This drives productivity gains, innovation incentives, and better integration of isolated regions of the country, among other positive effects.

Given the economic importance of telecommunications, public policies and regulatory frameworks need to be defined to maximize investment in network deployment, particularly in mobile broadband. Particularly, as it is becoming clearer in the current worldwide context, telecommunications also contributes to mitigate the disruption from emergencies such as the COVID-19 pandemic, by keeping the economy up and running by allowing, for example, citizens to telecommute. Therefore, public authorities should provide a flexible framework to allow the operators to react quickly to accommodate the increases of network traffic in such situations.

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