CHAPTER 1.6

The Economic Impact of Next-Generation Mobile Services: How 3G Connections and the Use of Mobile Data Impact GDP Growth

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Mobile communication services have become an essential part of how economies work and function, and the mobile telecommunication sector continues to offer unprecedented opportunities for economic growth in both developing and developed markets.

A series of studies have found a link between mobile penetration and economic growth.[1] Mobile phones have improved communication, enhanced social inclusion, and expanded economic activity and productivity in sectors such as agriculture, healthcare, education, and finance.

Against this backdrop, Deloitte and the GSM Association (GSMA) have performed a comprehensive and up-to-date analysis of the role that basic mobile phone services play in generating economic growth.[2] The study concludes that, in developing markets, increases in mobile penetration benefit gross domestic product (GDP) growth per capita and boost country productivity.

As technology develops, mobile services have the potential of impacting a country's economy by providing high-value 3G and 4G data services that are accessed via smartphones, tablets, and dongles that deliver mobile data services to businesses and consumers. The relationship among economic growth, 3G telephony, and mobile data use has not yet been explicitly explored; this chapter seeks to address this gap.

The chapter presents the first study of (1) the impact on GDP per capita growth of consumers substituting a 3G connection for a 2G connection, and (2) the impact of increasing the usage of mobile data per 3G connection, based on data from Cisco Systems. The details of the econometric analysis conducted are reported in more detail in a 2012 report prepared by Deloitte for the GSMA.[3]

THE IMPACT OF 3G PENETRATION ON GDP GROWTH

As mobile telephony markets become more mature, the benefits to be derived from basic mobile voice and text services on growth and productivity are achieved. Although the impact of 2G services is significant, as more developed 3G technology replaces 2G, an incremental economic impact is observed. Differential economic growth is supported because these

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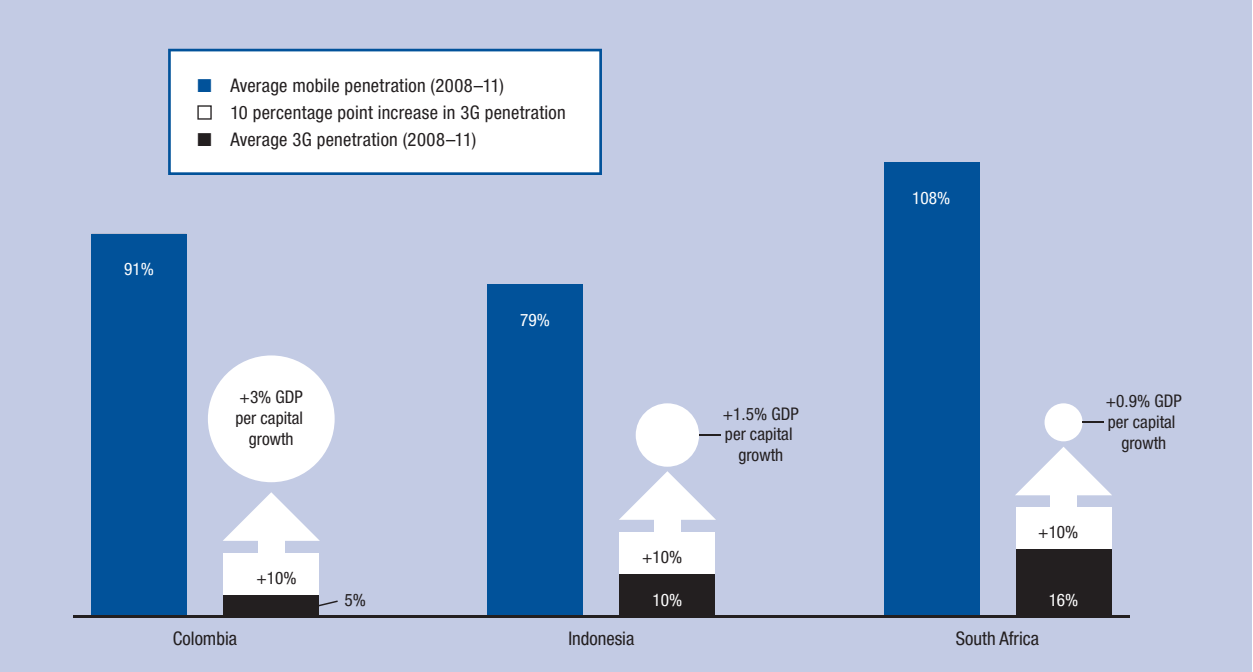
Figure 1: Potential impact of a 10 percentage point 3G penetration increase, selected countries



Source: Deloitte analysis.
Note: The size of the circle reflects the increase in GDP per capita growth due to the 10 percentage point increase in 3G penetration.

technology changes allow consumers and businesses to benefit from high-value wireless data and content services. This relationship had not yet been explicitly quantified yet.

The penetration of 3G technology—measured as the number of 3G connections per 100 people—has increased significantly worldwide in recent years: by 2011, 3G penetration had reached over 60 percent of the population in Western Europe and over 90 percent in the United States. This growth is supported by the availability of devices such as phones with 3G capabilities, smartphones, and tablets, all of which have recently proliferated.

In developed markets, where basic mobile penetration has long exceeded 100 percent, as well as in the higher-income consumer and business user segments in developing markets, a substitution effect has taken place in mobile telephony whereby mobile users who previously consumed standard services have been acquiring 3G connections. Although this substitution does not necessarily increase total mobile penetration, this section of the chapter quantifies the effect on GDP growth of consumers and businesses substituting a standard 2G mobile connection with a 3G connection.

The econometric approach adopted to measure this effect follows previous work on the impact of mobile penetration on GDP growth.[4] Including both total mobile penetration and 3G penetration in the econometric model allows us to interpret the coefficient of the 3G penetration variable as the impact of increasing 3G penetration while keeping all other factors equal, including total mobile penetration.

The central issue of reverse causality between mobile and 3G penetration and income growth, whereby higher levels of mobile and 3G penetration are expected to affect GDP but also higher income levels affect penetration, was given explicit consideration. We employed the generalized method of moments estimator of Arellano and Bond (1991), whereby mobile penetration and 3G penetration are instrumented using their own lags.

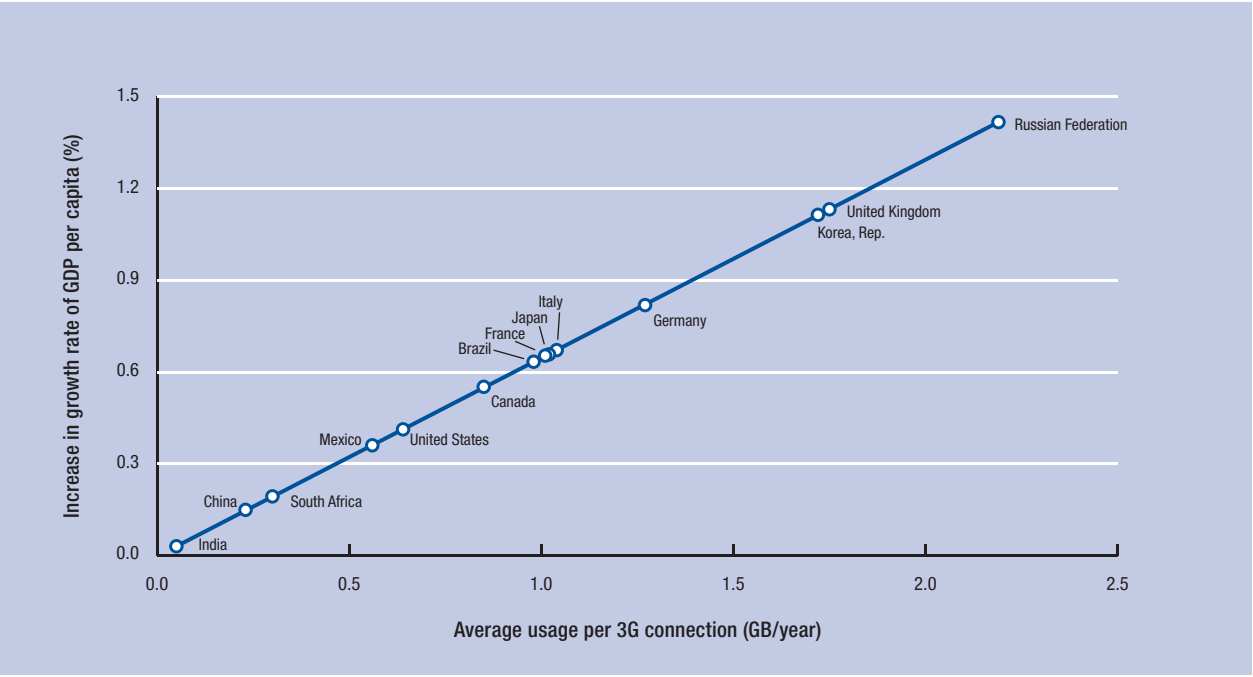
A panel of 96 countries was constructed with data covering 2008 through 2011.[5] Years before 2008 were not included in the analysis because of the late development of 3G networks in many countries.

The annual growth rate of real GDP per capita was expressed as a function of the lag of real GDP per capita, 3G penetration, mobile penetration, and a set of four determinants of growth. These determinants are government expenditure, trade volumes, aggregate investment, and total labor force. All variables have been transformed into logarithmic form.

This analysis finds that, for a given level of mobile penetration and across the whole sample of countries considered, those countries that had a 10 percent higher 3G penetration between 2008 and 2011 experienced an increase in their average annual GDP per capita growth rate of 0.15 percentage points.

These results indicate that countries with a proportionately higher share of 3G connections enjoy greater GDP per capita growth than countries with

Figure 2: The effect of doubling mobile data usage per 3G connection



Source: Deloitte analysis.

comparable total mobile penetration but lower 3G penetration.

For a similar absolute increase in the number of 3G connections, those countries with lower initial 3G penetration experienced a higher impact on GDP per capita growth. To consider three specific countries—Colombia, Indonesia, and South Africa: if each country had 10 more 3G connections per 100 total connections—that is, an increase of 10 percentage points—Colombia would have enjoyed an additional growth rate in GDP per capita of 3 percentage points, Indonesia would have generated an additional growth in GDP per capita of 1.5 percentage points, and South Africa would have enjoyed an additional 0.9 percent GDP per capita growth (Figure 1).

THE IMPACT OF MOBILE DATA ON GDP GROWTH

The increase in 3G connections, supported by the proliferation of data-enabled devices that allow mobile Internet connectivity, has led to massive growth in mobile data usage.

The Cisco Systems Visual Networking Index shows that, on average, total mobile data usage has more than doubled every year from 2005 to 2010 in each country in the sample.[6] In the United States, mobile data usage grew, on average, by 400 percent a year between 2005 and 2010, while in the Western European countries considered, it grew by an average of 350 percent. In countries such as Brazil, China, and India, total usage has also more than doubled, on average, every year since mobile data was introduced.

Mobile data usage per 3G connection also more than doubled, on average, every year from 2005 to 2010 in each country in the sample, despite the considerable increase in 3G connections. In the United States, mobile data usage per 3G connection grew, on average, by more than 300 percent a year between 2005 and 2010, while in the Western European countries considered it grew by 170 percent over the same period.

Growth in mobile data consumption, by transforming the way in which consumers and businesses operate and communicate, has had a notable impact on economic growth through increased productivity effects and economic activity. However, given the limited availability of data, this impact has not been fully investigated before.

For the first time, using detailed information provided by Cisco Systems on mobile data usage between 2005 and 2010 in 14 countries for which historical disaggregated data is available,[7] mobile data usage for each 3G connection in a country can be calculated.

The econometric approach introduced by Arellano and Bond (1991) made it possible to address the potential endogeneity of mobile penetration and mobile data usage by instrumenting these variables using their own lags. This technique also best exploits the information—such as the cross-country variation in the sample and the variation within countries across time—contained in the dataset.

The annual growth rate of real GDP per capita was expressed as a function of the lag of real GDP per capita, mobile penetration, mobile data usage per 3G

connection, and a set of determinants of growth such as aggregate investment and labor force. Logarithms of all variables were used, with the exception of mobile penetration and mobile usage, to which the inverse hyperbolic sine transformation has been applied. An additional parameter has also been included within each inverse hyperbolic sine transformation to accommodate more general forms of nonlinearity.

This analysis finds a positive relationship between the volume of mobile data used by each 3G connection and increases in economic growth. On average, across the sample of 14 countries considered, if countries doubled their consumption of mobile data per 3G connection between 2005 and 2010, they would have experienced a growth rate of GDP 0.5 percentage points each year.

The results indicate that mobile data usage per 3G connection has a positive effect on the growth rate of GDP per capita. This effect grows linearly with the initial level of data usage per 3G connection in the country: countries with a higher average level of mobile data consumption per 3G connection experience a larger impact on GDP per capita growth from increasing this consumption (Figure 2).

Countries such as Russia, the United Kingdom, and the Republic of Korea—which are characterized by a higher level of data usage per 3G connection—experience an increase in GDP per capita growth of up to 1.4 percentage points. The effect is more limited for countries that are still developing mobile data usage, such as China, India, Mexico, and South Africa, supporting scope for further growth.

CONCLUSION

This work has shown that, as more-developed 3G technology substitutes for 2G technology, there is a strong incremental impact on economic growth.

Although the study represents the first attempt to quantify the impact of advanced mobile telephony on GDP per capita growth, related studies consistently suggest that the adoption and use of successive new generations of mobile devices (i.e., consumers switching from 2G to 3G technologies and from 3G to 4G) have generated positive impacts also on employment growth.[8]

This economic growth is enhanced by the usage of mobile data services, which has boomed in developed markets in recent years and has a positive effect on an economy's GDP per capita growth.

To achieve the benefits highlighted in this chapter, governments must focus on increasing 3G and potentially 4G penetration in markets where mobile data services are still developing by encouraging the substitution of basic mobile services with more advanced connections and by supporting a fast increase of mobile data consumption.

NOTES

1 Qiang and Rossotto with Kimura 2009; Waverman, Meschi, and Fuss 2005; Deloitte 2006; Andrianaivo and Kpodar 2011; Lee, Levendis and Gutierrez 2009.

2 Deloitte 2012.

3 Deloitte 2012.

4 See Andrianaivo and Kpodar 2011; Lee, Levendis, and Gutierrez 2009.

5 See Deloitte 2012. These are the 96 countries for which 3G penetration data were available from 2008.

6 See Cisco VNI Mobile Highlights at http://www.cisco.com/web/solutions/sp/vni/vni_mobile_forecast_highlights/index.html; Cisco Systems has provided disaggregate historic data on mobile data usage for the purposes of this study.

7 The 14 countries for which data were available are Brazil, Canada, China, France, Germany, India, Italy, Japan, the Republic of Korea, Mexico, Russia, South Africa, the United Kingdom, and the United States.

8 For example, Shapiro and Hassett 2012.

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