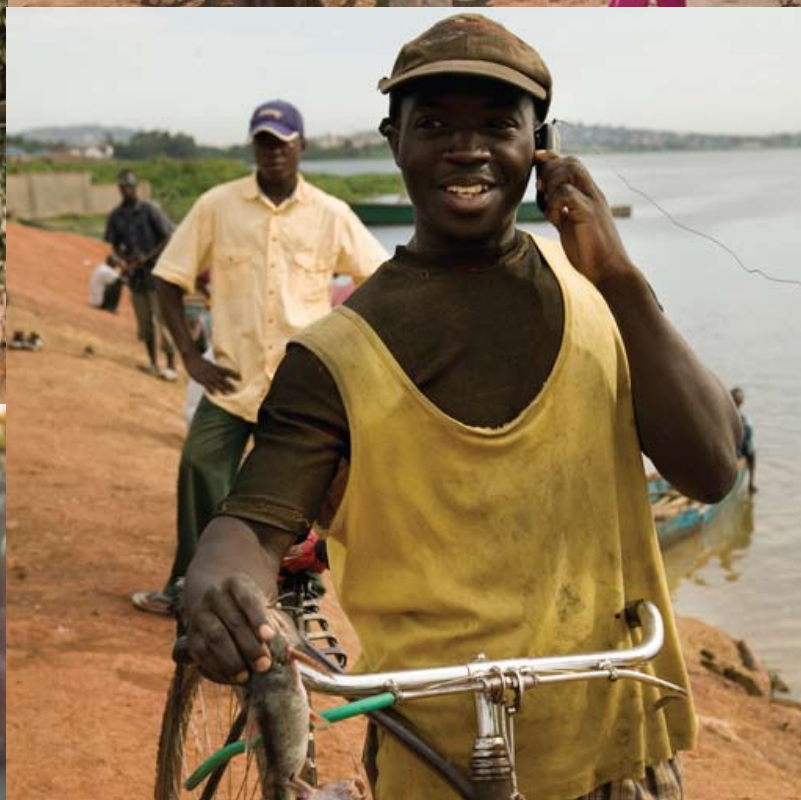
Taxation and the growth of mobile services in sub-Saharan Africa



Introduction from the GSMA

Introduction from the GSMA

The mobile industry in sub-Saharan Africa has pledged to invest some $50 billion over the next five years to extend coverage to rural areas and roll out mobile broadband services. This represents about a five-fold average increase in annual investment since the beginning of the decade.

This private sector commitment is something of a windfall for governments. Not only will it achieve national connectivity goals and ICT application targets in a timeframe unimaginable only a few years ago but also it will produce substantial levels of tax income. Based on this report, between 2000 to 2012, for every dollar invested by the mobile industry, around $0.80 will be earned in tax revenues by governments. For the same period more than $70 billion in tax revenue will be generated by the mobile industry. But the potential tax revenues could be even greater.

President Kagame says mobile phones are no longer a luxury but a necessity for Africans. Yet the majority of African governments levy luxury taxes on air time, handsets and equipment. These taxes are borne by consumers and have a negative impact on affordability. They are also regressive in nature, penalising poorer sections of society.

This report demonstrates why governments can afford to tax mobile phones as a common good and not a luxury. By lowering and removing mobile-specific taxes from the mobile sector, governments will see an incremental increase in tax receipts as millions more people will be able to afford to connect to and use mobile services.

Two thirds of sub-Saharan Africans who have mobile coverage are not yet connected; by lowering mobile specific taxes, governments will make mobile services more affordable for many of these 272 million people. The GSMA calls on governments to urgently review their mobile sector taxation strategies in consultation with the industry and other experts with a view to implementing an optimal taxation regime.

The GSMA would like to thank the following companies for their outstanding support for this project: Ericsson, MTN, Nokia, Nokia Siemens Networks, Orange, Safaricom, Vodacom and Zain / Celtel.

Vitalis Olunga
Chair, GSM Africa

Gabriel Solomon
Senior Vice President, GSMA

This Executive Summary and the full report can both be downloaded from www.gsmworld.com/africatax

English and French versions are available.

"In ten short years, what was once an object of luxury and privilege, the mobile phone, has become a basic necessity in Africa."

Paul Kagame, President of Rwanda

"We do not believe that taxation should be designed on the basis of short-term considerations – it should be designed on the basis of achieving the best long-term economic interests for the society and in a way that accelerates the extension of services to the poor. The indirect benefits to the economy of having affordable access to telecommunications services far outweigh any short-term benefit to the budget."

Mohsen A. Khalil, Director, World Bank

Executive summary

The GSMA commissioned Frontier Economics to conduct a study into the impact of mobile industry taxation as consumers across sub-Saharan Africa face some of the highest mobile-specific taxes world-wide.

This report builds on a 2007 GSMA report that examined the impact of air time taxes in East Africa[1] and extends the analysis from air time taxes to those levied on handsets and equipment across the sub continent.

The report quantifies and estimates the mobile industry's past and future effect on:

- Investment levels
- Tax contributions
- Economic growth
- Coverage and subscriptions

The report then analyses the impact of lowering and removing non-VAT related mobile-specific taxes on subscriptions, usage and the total tax generated by the industry. The report concludes that by removing mobile-specific taxes, mobile ownership and use will rise, stimulating wider economic growth and increasing the total amount of tax produced by the mobile industry in a number of countries.

Key Findings

- For the period 2000 – 2012, sub-Saharan governments will receive $71 billion in tax revenues from the mobile industry.

- This amount could be greater if mobile-ownership specific taxes, i.e. all non-VAT taxes relating to handsets, subscription and connections, were removed. For example, for the five year period 2007-2012 we estimate that:
  - Tax receipts would increase by $930 million, rising from $28.9 billion to $29.9 billion, if the governments of Nigeria, Kenya, Tanzania, Cameroon, Ghana, Zambia, DRC, Republic of Congo, Gabon, Madagascar, Burkina Faso, Chad and Malawi removed all non-VAT mobile ownership taxes in 2007;
  - By 2012, Chad's tax receipts would be approximately 30% higher, Ghana's 20%, Cameroon and Nigeria's 15%, Republic of Congo's 11%, Malawi's 8% and Zambia's 7%; and
  - The average cost of owning and using a mobile phone would fall substantially, in Republic of Congo by -25%, in Cameroon by -24%, in Chad by -22%, in Malawi by -18%, in DRC by -16& and in Nigeria by -14%; and
  - This would result in an additional 43.4 million mobile subscribers in those countries, increasing the 2012 projected weighted average penetration rate from 33% to 41%.

- For the 10 year period 2007 – 2017 we estimate that:
  - In Ghana, if all non-VAT taxes were removed in 2007, by 2017 tax revenues would be 38% above the base case and penetration would be 28% higher; and
  - In Cameroon, if non-VAT taxes were removed on handsets only in 2007, by 2017 tax revenues would be 24% above the base case and penetration would be 43% higher.

- In sub-Saharan Africa, eight governments levy luxury taxes on air time, 24 governments levy luxury taxes on handsets and more than 25 governments levy luxury taxes on equipment.

- In 2006, mobile tax contributions are broken down into the following categories:
  - 35% net VAT on services and handsets;
  - 34% corporate and employment taxes;
  - 20% import duties on handsets and equipment; and
  - 11% other mobile specific consumption taxes such as air time tax.

1 "Taxation and the growth of mobile in East Africa" www.gsmworld.com/eastafrica

- If non-VAT taxes were removed, governments in the majority of countries would receive incrementally higher tax returns as industry growth boosts total VAT receipts along with corporate and employment tax receipts.

- The average ratio of tax payments to mobile operator revenues is above 30%. The five countries with the highest ratios are Zambia 53%, Madagascar 45%, Tanzania 40%, Gabon 40% and Cameroon 39%.

- The average mobile tax contribution to government total national tax revenue is 7%. The five countries with the highest contributions are Chad 11%, Republic of Congo 10%, Gabon 9%, Tanzania 8% and Cameroon 8%.

- The mobile industry is a substantial generator of GDP, contributing around 4% on average in 2006. That year, the mobile industry contributed 5.3% GDP in Ghana, 4.3% GDP in South Africa, 4.1% GDP in Niger, 4% GDP in Nigeria, 4% GDP in Rwanda, 3.8% GDP in Uganda, 3.5% GDP in Tanzania and 3.4% GDP in Kenya.

- For the period 2000-2012, GSMA estimate that between $85 billion and $98 billion will be invested by the mobile industry in sub-Saharan Africa. $13 billion more would be invested between 2008 and 2012 if government in sub-Saharan Africa lowered regulatory risk and removed mobile-specific taxes. [2]

- In 2007, the mobile industry employed more than 3.5 million people directly or indirectly in sub-Saharan Africa.

- In 2007, mobile networks covered more than 60% of the population in sub-Saharan Africa, providing around 434 million people with access. Of those covered, 162 million were connected, implying a 37% penetration rate among those covered by mobile networks in sub-Saharan Africa.

Recommendations

Mobile phones are a vital socio-economic necessity in modern Africa. It is therefore incumbent upon governments to view their proliferation across all societies as a priority. Imposing luxury taxes on mobile consumers is no longer appropriate. Poorer sections of society are hit hardest by the regressive taxes that widen the digital divide.

Governments that levy luxury taxes on mobile consumers should urgently review such policies in consultation with the industry and other economic and taxation experts. By removing luxury taxes on mobile consumers and moving to a more optimal tax structure:

- Many millions of Africans will be able to afford to connect to and communicate on mobile networks for the first time;

- Governments will reap incremental increases in tax payments from the industry; and

- Wider economic and social benefits will be enjoyed by all.

2 For example, in the report 'Regulation and the Digital Divide', PwC estimated that best practice regulatory conditions in sub-Saharan Africa would increase investment by 25% www.gsmworld.com/regulation

Tax Analysis

There is a negative correlation between higher taxes and mobile penetration. Removing non-VAT mobile specific taxes will increase the affordability of mobile services and boost penetration.

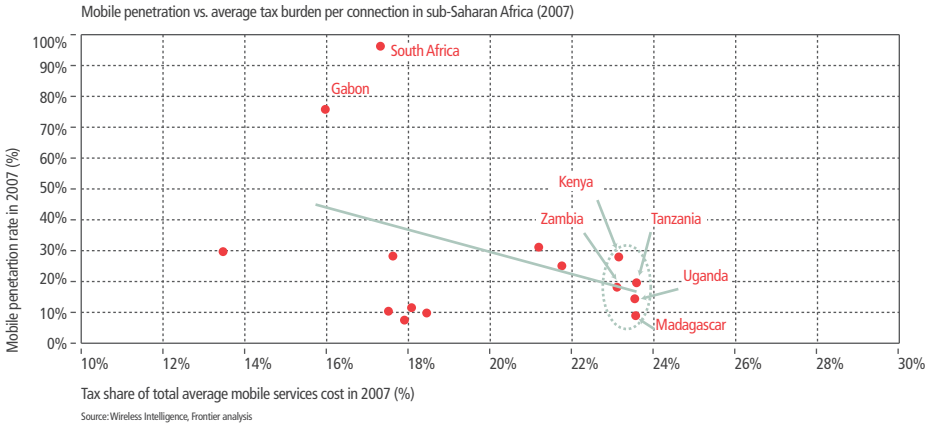


Figure 1

Figure 2 below illustrates the impact of removing all non-VAT taxes on the tax revenue produced by the mobile industry in sub-Saharan Africa.

Figure 2

Following a short initial period where the total tax take may be lower than if the status quo is maintained, in the medium to long term, tax levels rise exponentially above the base case.

For all the countries in our sample, penetration increases, and in most cases very significantly, after the removal of non-VAT taxes. For the majority of countries analysed in our sample, after a period of only three to four years, as Figure 3 shows, the removal of all non-VAT mobile-specific taxation becomes positive..

Figure 3

In some cases, a positive impact can be immediate. In Ghana, for example, if all non-VAT taxes were removed, the impact is positive from year one. For the period 2007 – 2017, penetration is expected to be 28% above the base case and tax receipts are expected to increase by 38% above the base case. See Figure 4 below.

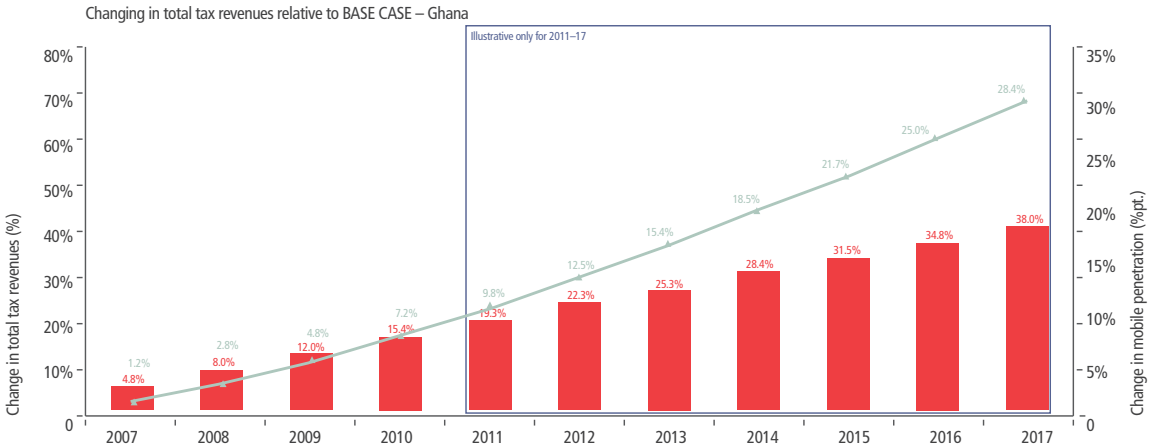


Figure 4

In other cases, the positive impact on total tax revenues can take longer. In Cameroon, for example, if handset-related taxes (excl. VAT) were removed, although there is an immediate positive impact on penetration, it takes longer for the total tax take to become positive.

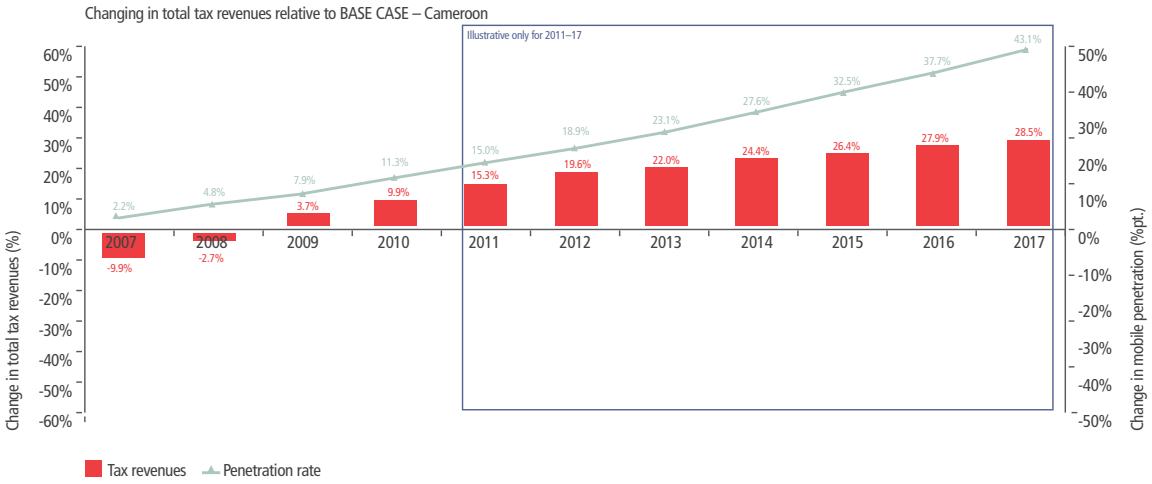


Figure 5

As Figure 6 shows below, removing non-VAT mobile taxes substantially increases the affordability of mobile phones.

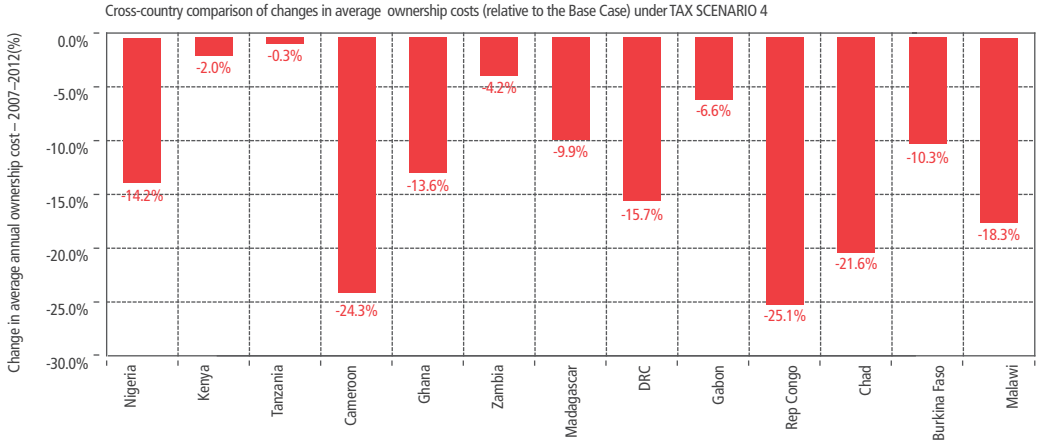


Figure 6

Industry Performance

Investment levels

The mobile sector in sub-Saharan Africa is in a second phase of private sector investment. The first phase of investment was characterised by entrepreneurial endeavours where the private sector and multilateral agencies such as the International Finance Corporation backed companies to cash flow positive positions. Mobile networks covered mostly urban areas as investors in the early phase could not fund rural expansion. International financial markets were hard to tap following the bursting of the dot com bubble.

The second phase of investment began in 2005 as international and African investors recognised there was significant value in the growth potential of mobile operations across Africa. Handset and equipment costs had fallen sharply thanks to unprecedented economies of scale. A wave of mergers and acquisitions began. Mobile operators were able to raise funds from international financial markets that backed business plans calling for extensive network roll outs and capacity upgrades.

3 For example, in the report "Regulation and the Digital Divide", PwC estimated that best practice regulatory conditions in sub-Saharan Africa would increase investment by 25% www.gsmworld.com/regulation

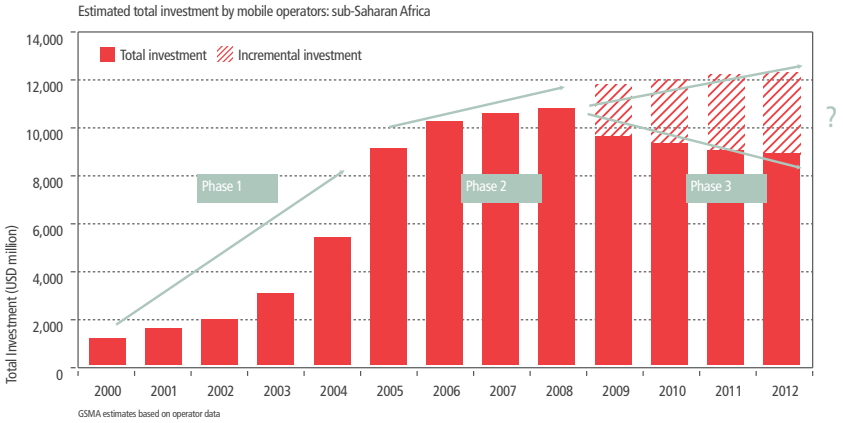


Figure 7

As we move into a third phase in the next few years, government policy will be critical to ensure that private sector investment is maximised. Both fiscal and regulatory conditions will influence the level of investment.

Tax contributions

The share of operator revenues that is paid in any type of tax varies considerably, from 53% in Zambia to 16% in the Democratic Republic of Congo. On average, it is above 30%.

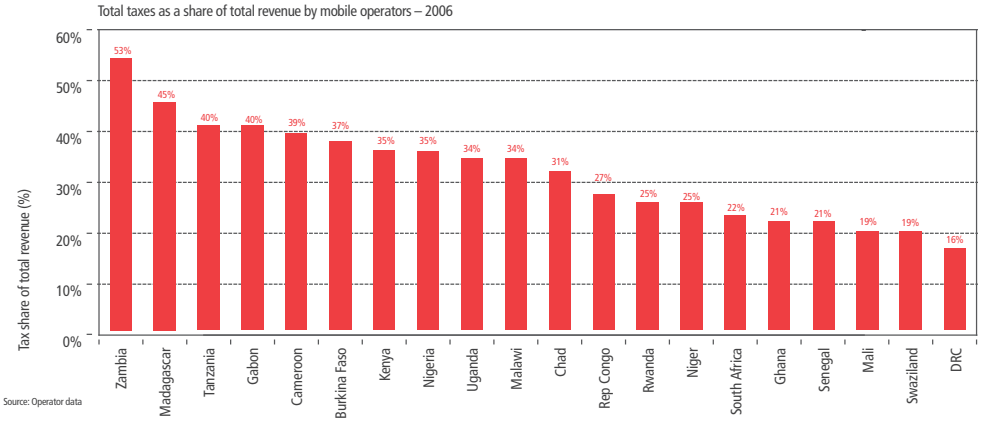


Figure 8

As the industry grows, so will its tax contribution, which we estimate will total $71 billion between 2000 – 2012.

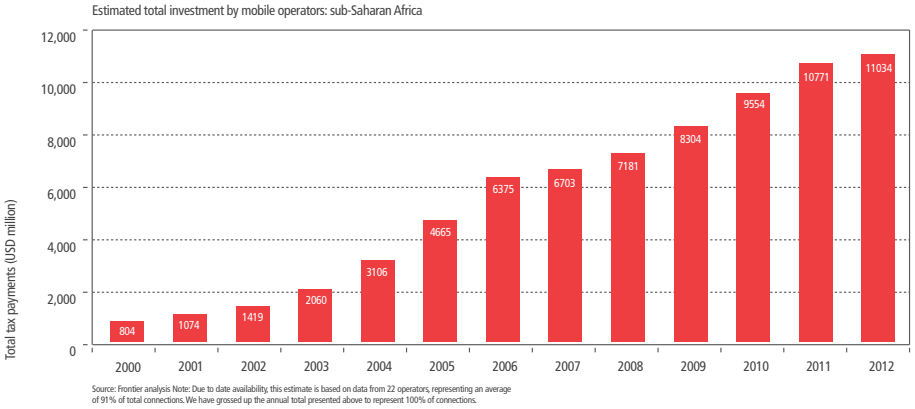


Figure 9

Economic growth

In 2007, the mobile industry employed more than 3.5 million people directly and indirectly across sub-Saharan Africa. On average, tax collected from the mobile industry was estimated to contribute 7% of governments' total budget and ranged between 11% in Chad to 1% in Swaziland.

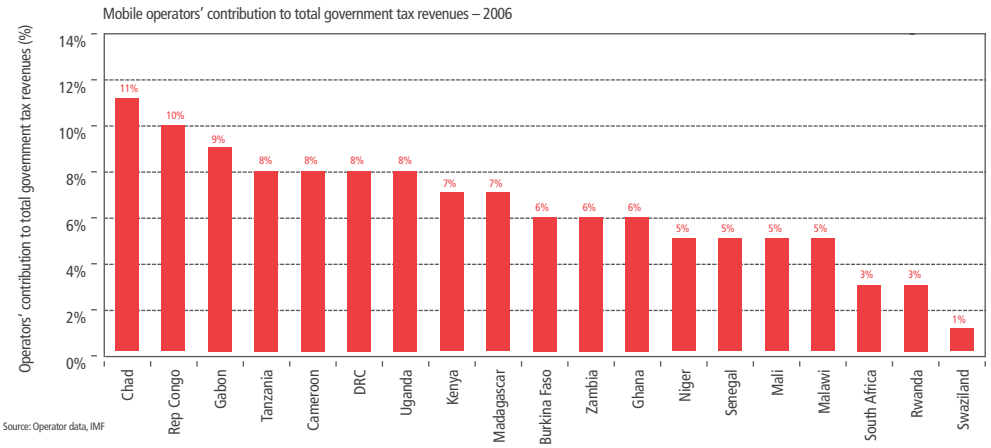


Figure 10

In a typical sub-Saharan Africa country, a 10% increase in mobile penetration increases Gross Domestic Product (GDP) by 1.2%. [4]

Figure 11 below shows the estimated share of GDP accounted for by the mobile industry across 16 countries.

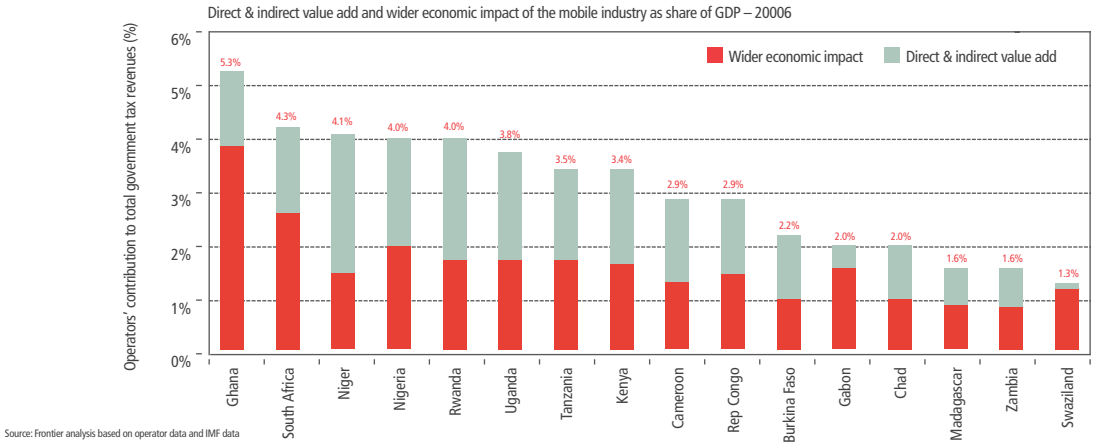


Figure 11

These GDP estimates do not include an allowance for any wider productivity gains which could be attributed to mobile use and exclude the value-added generated by mobile phone vendors. The full effect is therefore expected to be higher.

4 "Global mobile tax review 2006-07" www.gsmworld.com/tax

Coverage and penetration

In 2007, more than 430 million sub-Saharan Africans (60% of the population) were covered by mobile networks. With around 162 million connections, this implies a penetration rate of 37%.

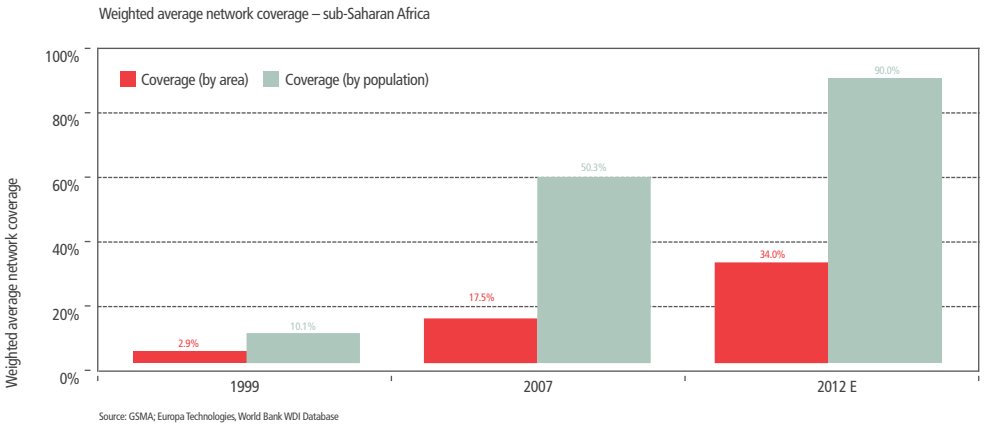


Figure 12

Mobile networks cover an area of around 4.25 million square kilometres, equivalent to the size of Europe. The remaining 290 million sub-Saharan Africans, about 40% of the population, to be covered by mobile networks, live in an area of around 20 million square kilometres, a land mass greater than China, India and Europe combined.

Tax Benchmarks

Taxation structures and levels vary considerably across sub-Saharan Africa. Below are some benchmarks of countries that levy taxes on network equipment, handsets, and air time.

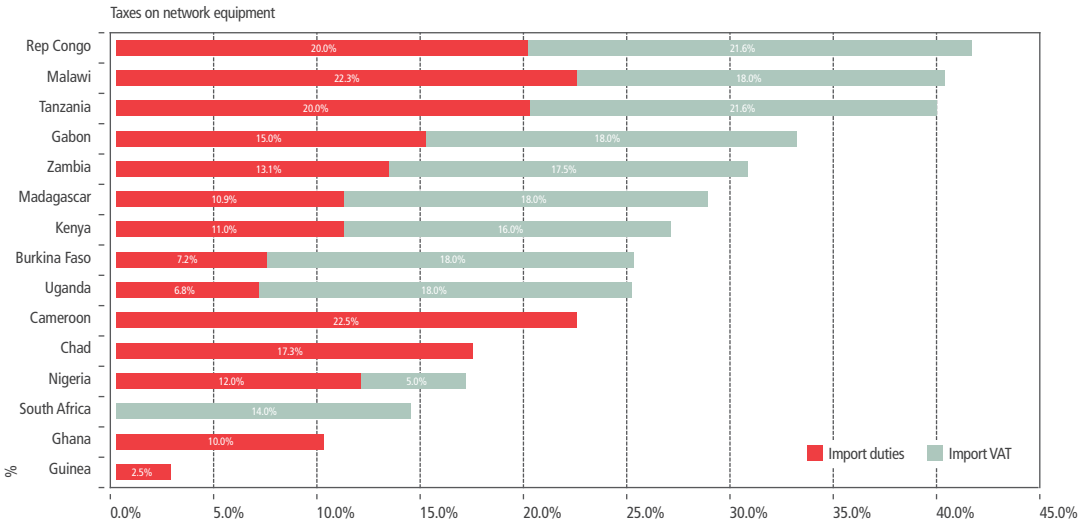
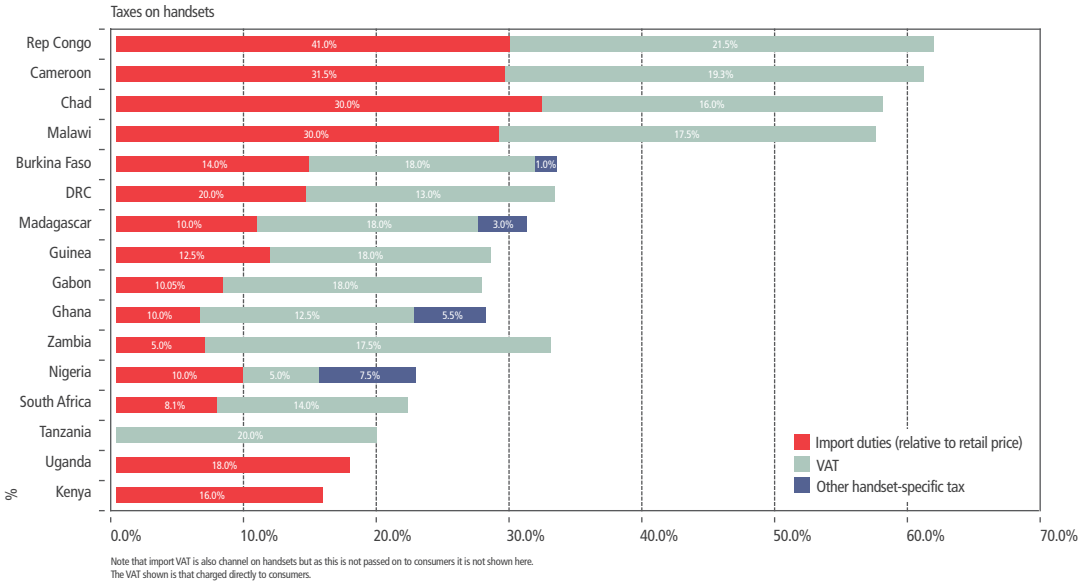


Figure 13



Note that import VAT is also channel on handsets but as this is not passed on to consumers it is not shown here.
The VAT shown is that charged directly to consumers.

Figure 14

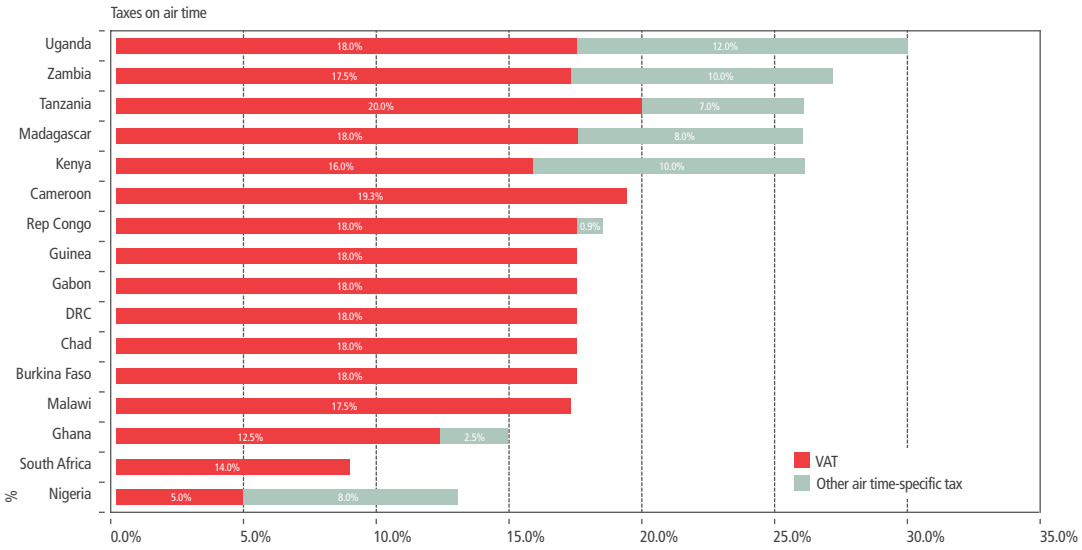


Figure 15

Introduction

Introduction

1 Introduction

Over the past decade, the number of mobile connections in Sub-Saharan Africa has increased ten fold and over 173 million people in the region are now covered by mobile phone networks. The use of mobile phones throughout Sub-Saharan Africa is expected to continue to grow.

The GSMA has commissioned Frontier Economics Ltd to conduct a study into the impact of taxation on the mobile industry in the Sub-Saharan region of Africa. This study aims to identify ways in which Governments and regulators can take steps which will improve access to mobile telecommunications in this part of the world. The project has been sponsored by the following organisations, which all have a presence in Sub-Saharan Africa:

- MTN;
- Vodacom;
- Celtel;
- Orange;
- Safaricom;
- Nokia;
- Nokia Siemens Networks; and
- Ericsson

In this report, we first consider the significance of mobile telephony in 30 countries within Sub Saharan Africa. Within this context, we then consider through a range of analytical techniques, the role that taxation of mobile services has had on the development of the industry and how changes in the prevailing tax regimes may affect its future development.

1.1 ANALYSIS

The GSMA specified thirty countries which should be incorporated in the analysis – these are[1]:

- Benin
- Botswana
- Burkina Faso
- Cameroon
- Chad
- Madagascar
- Mali
- Malawi
- Mozambique
- Nigeria

[1] See Annexe 6: Operators by country for a table indicating which of the major operators sponsoring this study are present in each country.

- Republic of Congo
- Cote d'Ivoire
- Democratic Republic of Congo
- Gabon
- Ghana
- Guinea Bissau
- Guinea Republic
- Kenya
- Lesotho
- Liberia
- Rwanda
- Senegal
- Sierra Leone
- Swaziland
- South Africa
- Sudan
- Tanzania
- Uganda
- Zambia

As explained below, we have not been able to obtain complete data sets for all 30 countries. See Annexe 1: for more details on the exact set of countries incorporated into each part of our data analysis.

Where possible we have relied upon data provided by the four major operators (MTN, Vodacom, Orange & Celtel) to generate estimates of relevant market wide metrics for each of these countries. However, where this data has been unavailable we have made use of other public data sources including Wireless Intelligence, Telegeography, WCIS Informa, ITU, World Bank & the IMF.

1.2 THE STRUCTURE OF THE REPORT

The remainder of this report is divided into the following sections:

- **Section 2: Data sources,** discusses in more detail the data sources used throughout the report.
- **Section 3: The significance of mobile telephony**
  - **Section 3.2: Development of the mobile sector in the region,** presents a range of data to illustrate how the industry has performed historically and how it is expected to perform in the future.
  - **Section 3.3: Contribution of the mobile sector to the region,** considers the financial contribution that the mobile industry has made.
  - **Section 3.4: Economic impact of the mobile industry,** presents estimates of the overall economic impact that the mobile industry makes in each of the relevant countries.
- **Section 4: Expected impact of changes in current tax regimes,** presents the results of our tax simulation model to estimate the potential effect that different hypothetical tax scenarios could have on demand for mobile services and on the government tax revenues that they generate.

- **Section 5: Tax and mobile industry,** presents data on taxation and the industry across our sample of countries.

2 Data sources

In this section we set out details of the data sources we have used to generate the data sets required to perform the necessary quantitative analysis.

2.1 OPERATOR DATA

To enable us to perform the necessary analysis, data have been provided by each of the stakeholders involved in the study. We requested data for the 30 countries in which at least one of the operators sponsoring the study is present, which together account for 94% of all mobile connections across Sub Saharan Africa.

In some cases, the data provided by operators was insufficient to determine the values of the necessary market-wide data, either because the operators concerned do not account for the whole market in a given country or because the data provided was incomplete. In these instances, it has been necessary, where the data available for the operators that we did have was robust, to scale up operator data to the overall market. To do this, we applied the following rules:

- Investment grows at same rate as net increase in subscriber numbers
- Investment by main type of equipment is in same proportions across all operators active in a country
- Operators' total investment is scaled to market, based on market shares of net additions
- The following variables are scaled to the entire market, based on market shares of total connections:
  - operators' total revenues;
  - operators' total taxes paid;
  - operators' profits before tax;
  - operators' total wage costs;
  - operators' opex; and
  - total minutes of usage.
- Where the following variables have not been provided by all operators, we have assumed that a weighted average of the data that has been provided is a suitable proxy for the market:
  - average monthly usage per subscriber;
  - share of total revenues represented by individual service revenues; and
  - share of total revenues represented by main types of equipment.

Note that where we have used the total number of connections to generate a market wide estimate of a particular variable, we implicitly assume that for all operators in a market, the value of the variable being scaled up is the same, e.g.

average revenue per user (ARPU), wage costs per connection and total taxes per connection are the same, for all operators in the market.

Tax payments

Where data is missing on the total amount of tax paid we have attempted to produce "bottom-up" estimates. Specifically, we have used information available on tax rates and the appropriate tax bases to estimate the amount of each of the main types of tax we expect the operators to have paid – VAT, mobile specific consumer taxes, corporate tax, employment taxes & import duties.

Our estimates do not take into account any tax breaks or other tax planning that may be undertaken by the mobile operators to minimise their tax burden. In addition, those taxes where detailed and often confidential data are required to estimate the underlying tax base, such as withholding tax and secondary tax on companies, have been excluded.

Based on data provided by the participating operators we have used the following tax rates in our bottom-up estimates of tax paid.

Country	Input Taxes							Employment		Corporate Tax
	Equipment					Handsets				
	Import Duties*									
	Radio equipment	Transmission equipment	Switching & core network equipment	Software	Import VAT	Import Duties	Import VAT	Income Tax	National Insurance	
Burkina Faso	7.5%	8.0%	7.5%	0.0%	18.0%	14.0%	18.0%	30.0%	30.0%	35.0%
Cameroon	22.5%	22.5%	22.5%	22.5%		31.5%	0.0%			38.5%
Chad	26.8%	14.2%	14.2%	39.6%		30.0%	0.0%			45.0%
Rep Congo	20.0%	20.0%	20.0%	20.0%	21.6%	41.0%	21.6%	30.0%		38.0%
DRC	0.0%	0.0%	0.0%	0.0%		20.0%		40.0%		40.0%
Gabon	15.0%	15.0%	20.0%	0.0%	18.0%	10.0%	18.0%	22.1%	20.1%	25.0%
Ghana	10.0%	10.0%	10.0%	10.0%		10.0%	15.0%			25.0%
Guinea	2.5%	2.5%	2.5%	2.5%		12.5%				35.0%
Kenya	10.0%	10.0%	10.0%	25.0%	16.0%		16%***			30.0%
Madagascar	10.0%	10.0%	10.0%	20.0%	18.0%	10.0%	18.0%			30.0%
Malawi	45.0%	5.0%	10.0%	0.0%	18.0%	30.0%	18.0%	29.0%		30.0%
Nigeria	12.0%	12.0%	12.0%	0.0%	5.0%	10.0%	5.0%	25.0%		30.0%
South Africa	0.0%	0.0%	0.0%	0.0%	14.0%	8.1%	14.0%			29.0%
Tanzania	20.0%	20.0%	20.0%	20.0%	20.0%		20.0%	15.0%		30.0%
Uganda	10.0%	0.0%	10.0%	0.0%	18.0%		18.0%		30.0%	30.0%
Zambia	15.0%	15.0%	10.0%	0.0%	17.5%	5.0%	17.5%	30.0%	5.0%	35.0%

Country	Output Taxes						
	Handsets		Airtime		Subscriptions & Connections		
	VAT	Other*	VAT	Other*	VAT	Other*	Fixed
Burkina Faso	18.0%	1.0%	18.0%		18.0%		0.07 CFC****
Cameroon	19.3%		19.3%		19.3%		
Chad	18.0%		18.0%		18.0%		
Rep Congo	21.6%		18.0%	0.9%	0.0%		
DRC	13.0%		18.0%		0.0%		
Gabon	18.0%		18.0%		18.0%		
Ghana	12.5%	5.5%	12.5%	2.5%	12.5%	2.5%	
Guinea	18.0%		18.0%		18.0%		
Kenya	16.0%		16.0%	10.0%	0.0%		
Madagascar	18.0%	3.0%	18.0%	8.0%	18.0%	0.0%	
Malawi	17.5%		17.5%		17.5%		
Nigeria	5.0%	7.5%	5.0%	8.0%	5.0%	0.0%	
South Africa	14.0%		14.0%		14.0%		
Tanzania	20.0%		20.0%	7.0%	20.0%		
Uganda	18.0%		18.0%	12.0%	18.0%		
Zambia	17.5%		17.5%	10.0%	17.5%		

* "Other" refers to mobile-specific taxes
** excluding 3.65% of other taxes on imported equipment
*** excluding 2.25% IDF fee on handsets
**** levied on subscription only

Figure 1: Tax rates used for estimating tax payments

Source: Operator data / Deloitte for the GSMA report "Global mobile tax review 2006-07"

2.1.1 Missing forecasts

To evaluate different tax scenarios on the market, we have estimated over a four year period, the impact of changes in tax rates on key mobile market variables (such as penetration, tax revenues and mobile usage). Unless operator-specific forecasts were provided, the following rules have been applied in order to extrapolate the data available so that reasonable forecasts could be derived:

- Total revenue grows at the same rate as total connections.
- If grossing-up forecasts, subscriber market shares are assumed constant from 2007 onwards.
- Share of pre-pay connections remains constant.
- Change in average annual usage per connection follows historic trend.

2.2 PUBLIC DATA

The data collected from operators has been complemented with data taken from public sources. These sources include:

- Wireless Intelligence
- Telegeography
- WCIS Informa
- ITU

- World Bank
- The IMF

The table below indicates where we have made use of public data and where it was obtained from:

Variable	Source
Financial information:	
Total revenue	Operator provided data & ITU
Investment	Frontier analysis based on data from operators, Wireless Intelligence & WCIS Informa
Operational information	
No. of connections	Wireless Intelligence
No. of pre-pay connections	Wireless Intelligence
Mobile penetration	Wireless Intelligence
No. employees	Operator provided data & ITU
Fixed line network coverage	Telegeography
Mobile network coverage (population)	GSMA
Mobile network coverage (geographical)	GSMA
Macro-economic variables:	
GDP / GDPpc (current cost)	IMF Regional Economics Outlook Report 2007
GDP / GDPpc (PPP)	IMF Regional Economics Outlook Report 2007
Government tax revenues	IMF Article IV Consultations
National Savings	World Bank / IMF
National imports	World Bank / IMF
Total population	World Bank World Development Indicators / WCIS Informa (forecasts induced from forecast penetration rates)

Table 1: Data sources

2.3 DATA SETS

As it was not possible to obtain complete data sets for all 30 countries, we have often had to present data or perform analysis for a smaller, partial sample of countries. For each part of our analysis we have tried to maximise the amount of

data used and therefore the sample size varies. A detailed breakdown of the countries included in each part of the analysis is presented in Annexe 1: .

Data sources

3 The significance of mobile telephony in Sub-Saharan Africa

3.1 OBJECTIVES

In this section we show how rapidly the mobile sector has developed across Sub-Saharan Africa and how this is expected to continue going forward. We also show how important its contribution has been to those countries' economies in terms of the revenue and employment generated by mobile operators as well as the wages, taxes and capital expenditure they incur. Finally, we provide, for a sample of the countries in Sub-Saharan Africa, an assessment of the overall economic impact of the whole mobile sector.

3.2 DEVELOPMENT OF THE MOBILE SECTOR IN THE REGION

In this section, we assess the development of the mobile industry in Sub Saharan Africa since the start of the decade and also consider how this is forecast to progress going forward.

In particular, we concentrate on:

- trends in coverage;
- trends in the number of connections and penetration rates; and
- the relative growth of mobile and fixed line services.

3.2.1 Trends in coverage

As shown in Figure 2, the region's mobile networks have grown considerably since 1999 and now over half of the population have access to a mobile network. By 2012, this is expected to increase further so that approximately 90% of the population will be covered by mobile networks. [2]

[2] We understand this forecast is based on the assumption that within the period the Ethiopian market will open to at least one new entrant. An equivalent estimate of future geographical network coverage is not available.

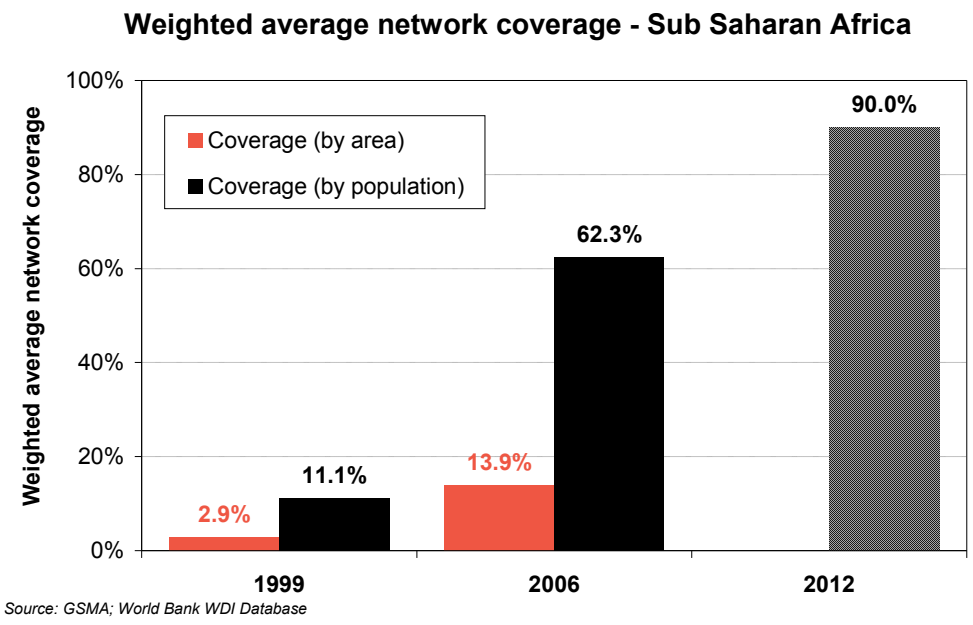


Figure 2: Weighted average network coverage in Sub-Saharan Africa

Source: GSMA

3.2.2 Trends in number of connections and penetration

By 2007, mobile penetration across Sub-Saharan Africa had reached approximately 27% of the overall population. Further, total connections and mobile penetration are projected to continue to grow to 2012. Across the entire sample average growth in total connections over the period to 2012 is forecast to be 76%, although the projected rate of growth varies by country. As shown in Figure 3, the actual and projected trends in mobile penetration exhibit the classical "S"-shape. After slow growth during the initial years, penetration tends to increase substantially, before eventually slowing down as the market matures. Note that individual countries are likely to be at very different points on the S-curve.

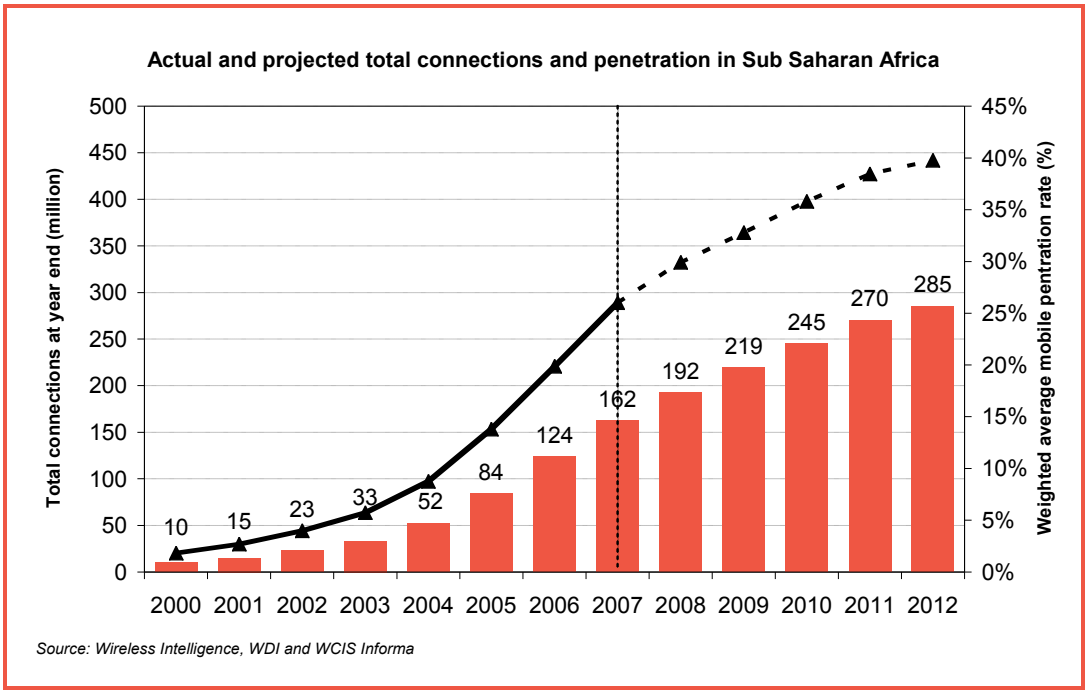
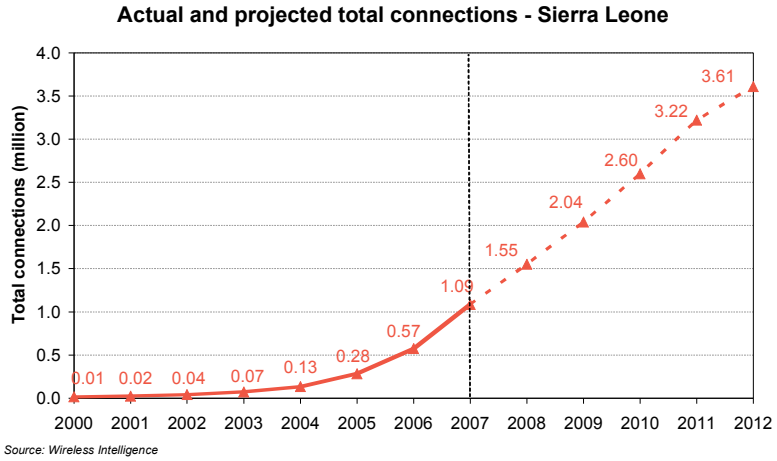


Figure 3: Total connections and overall penetration across the sample of 30 SSA countries, 2000 - 2012

Source: Wireless Intelligence, WDI & WCIS Informa / Frontier analysis

Several markets where penetration is currently low are projected to grow more rapidly than their contemporaries. This is true in Sierra Leone (where over the 5 years to 2012, total connections are expected to increase by 439%) and Madagascar (where over the 5 years to 2012, total connections are expected to increase by 348%) – see Figure 4 below.



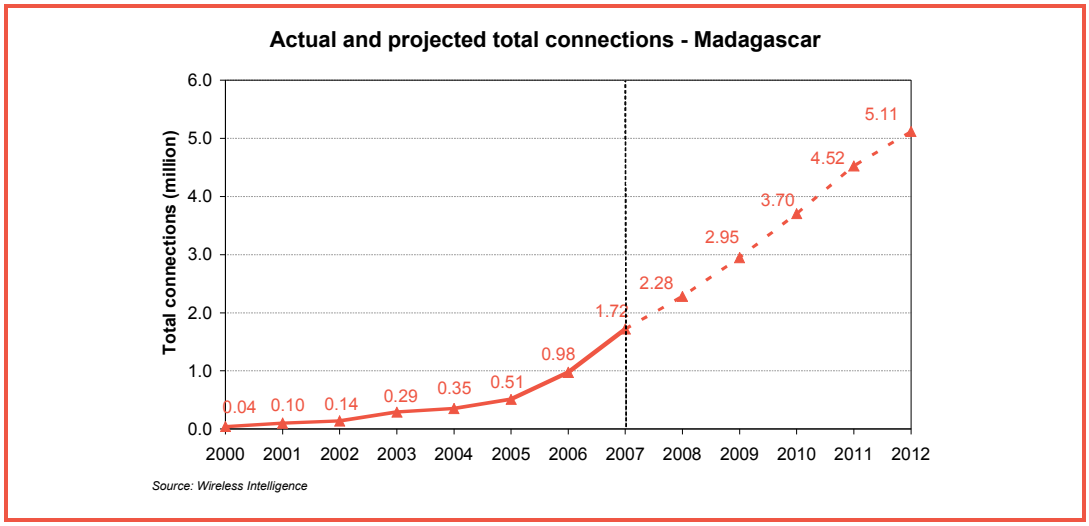
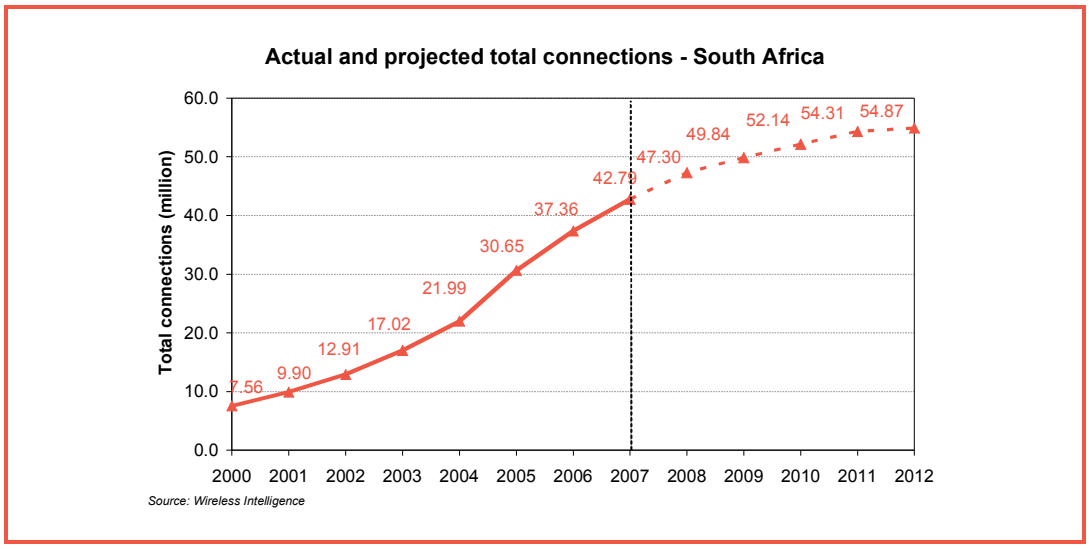


Figure 4: Total connections in Sierra Leone & Madagascar

Source: Wireless Intelligence / Frontier analysis

Some of the slower growing markets appear to be more mature and have already achieved relatively high levels of penetration. As shown below in Figure 5, in South Africa (where over the 5 years to 2012, total connections are expected to increase by 32%) and Senegal (where over the 5 years to 2012, total connections are expected to increase by 66%) the rate of growth in the number of connections is starting to decrease over time.



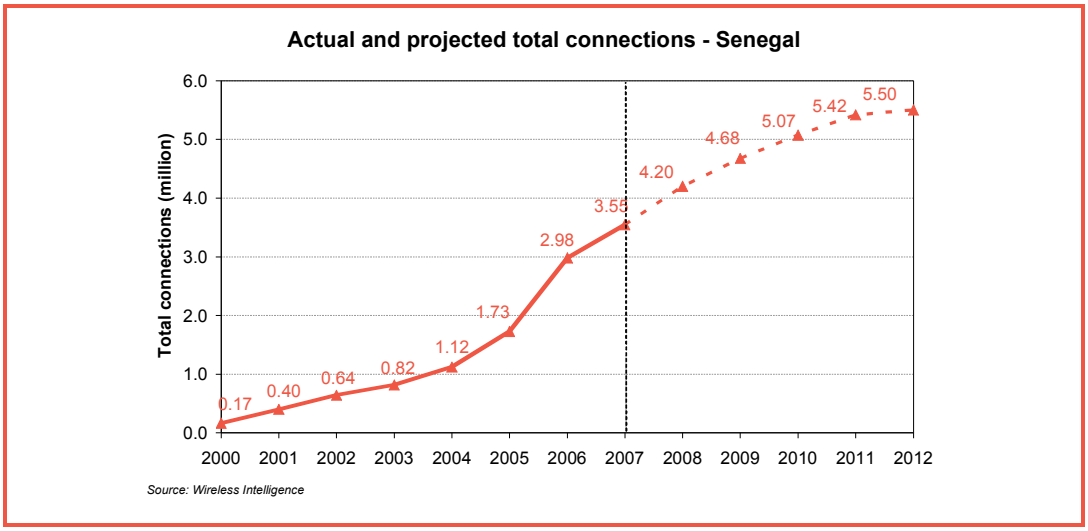


Figure 5: Total connections in South Africa & Senegal

Source: Wireless Intelligence / Frontier analysis

In 2000, South Africa had 75% of all connections within our sample of 30 SSA countries but by 2007, South Africa's share of total connections in our sample, had fallen to 26%, while Nigeria had, in terms of the # of connections, become the largest market. By 2012, Nigeria is expected to have over 30% of all connections across the countries in our sample.

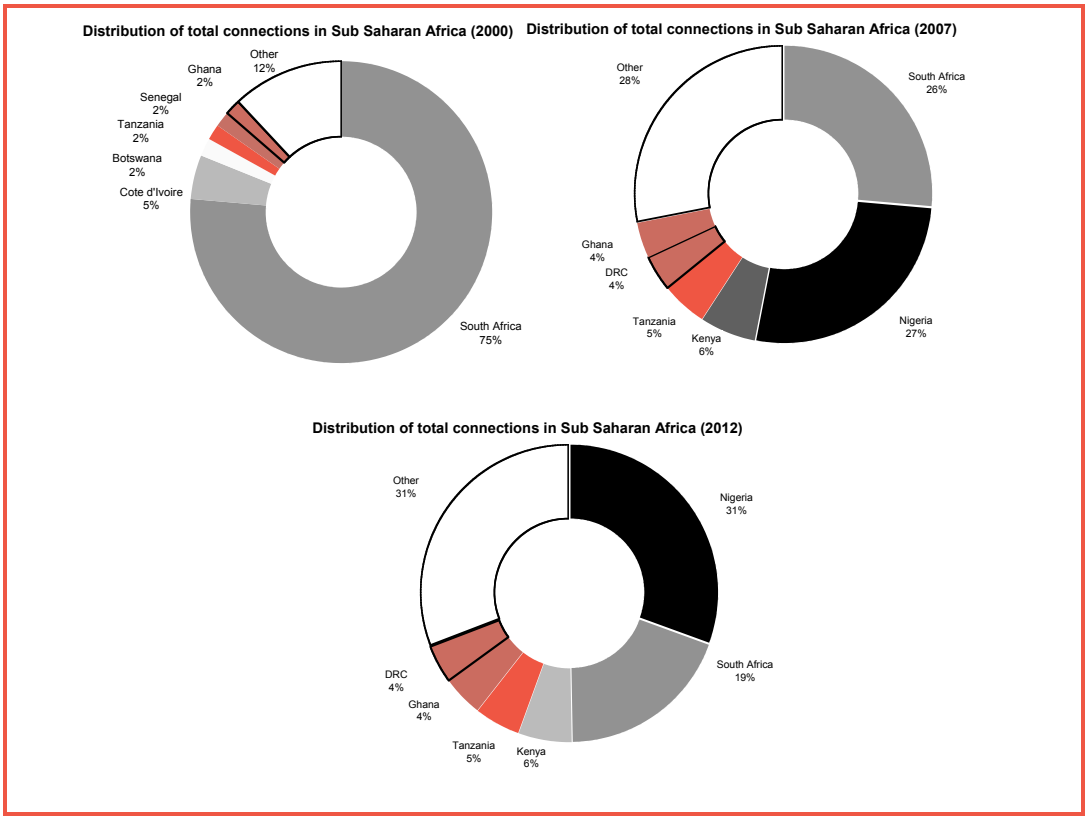
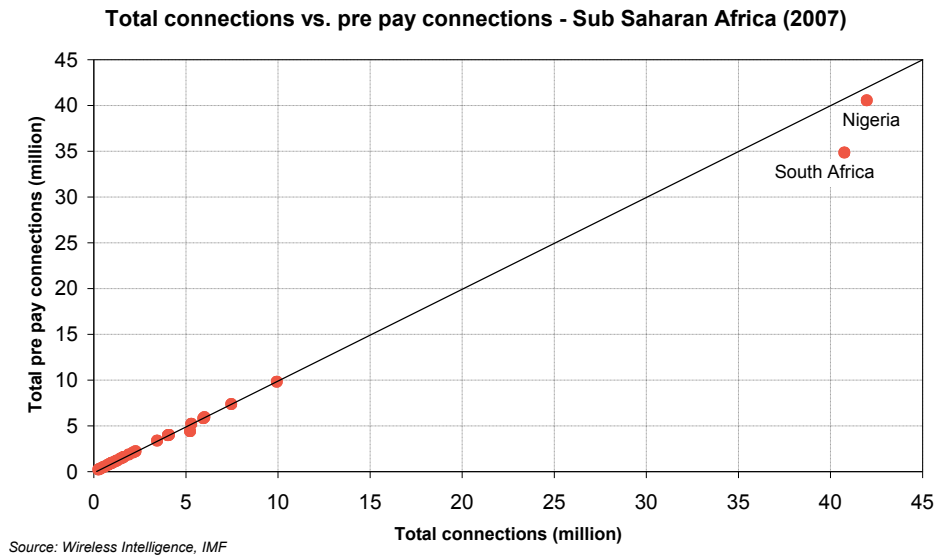


Figure 6: Distribution of total connections across Sub-Saharan Africa in 2000, 2007 & 2012

The significance of mobile telephony in Sub-Saharan Africa

Source: Wireless Intelligence / Frontier analysis

The mobile industry in Sub-Saharan Africa remains characterised by a high share of pre-pay users – the mobile users in all countries on or close to the 45 degree line in the charts shown in Figure 7 below use pre-pay mobile phones. Across the region only South Africa has a sizeable proportion of post-pay contracts but amongst the countries with smaller mobile markets, Cote d'Ivoire has the most significant proportion of post-pay subscribers – see the second chart in Figure 7 below.



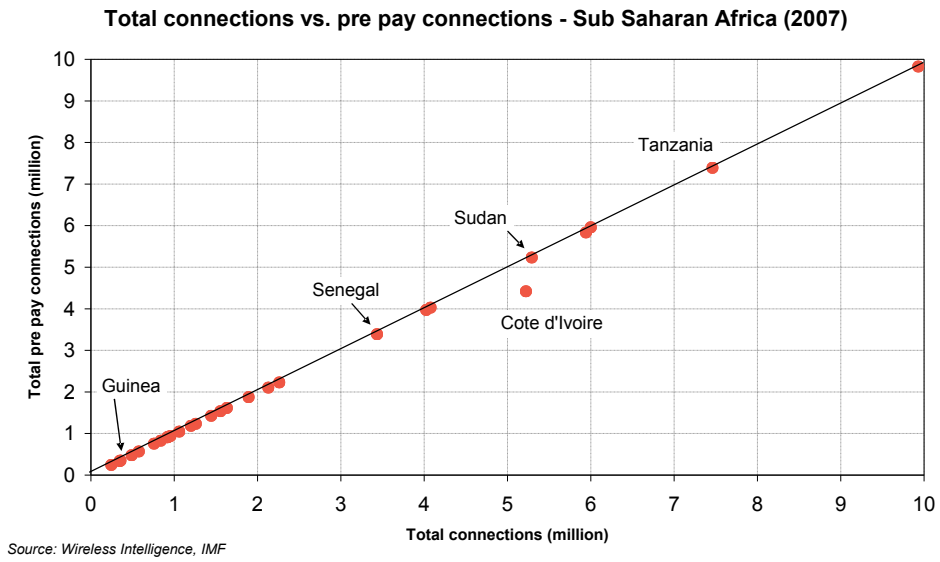


Figure 7: Total connections vs. pre-pay connections in Sub-Saharan countries in 2007 (including and excluding countries with the largest mobile markets)

Source: Frontier analysis

3.2.3 Relative growth of mobile & fixed line telephony

As shown in Figure 8, mobile telephony currently dominates fixed line telephony across the region. Whereas fixed penetration has remained fairly constant over time, mobile penetration has increased year on year since 2000[3].

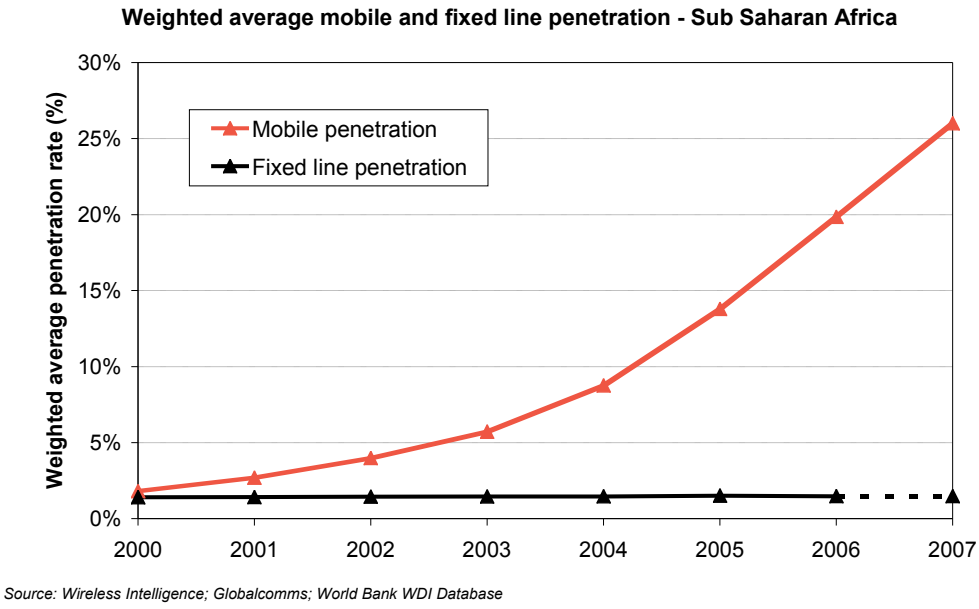


Figure 8: Mobile and fixed penetration rates across Sub-Saharan Africa as a whole

Source: Wireless Intelligence; Globalcomms; World Bank WDI database / Frontier analysis

In many of the countries in the region, mobile technology has effectively "leap-frogged" the development of a fixed-line network. For example, we show in Figure 9, the relative growth of fixed and mobile telephony in a sample of countries in the region. In every case, although mobile penetration has increased (at differing rates), fixed line penetration has remained largely unchanged.

[3] Note that the weighted average fixed line penetration series shown excludes Burkina Faso, Niger, Rwanda & Zambia.

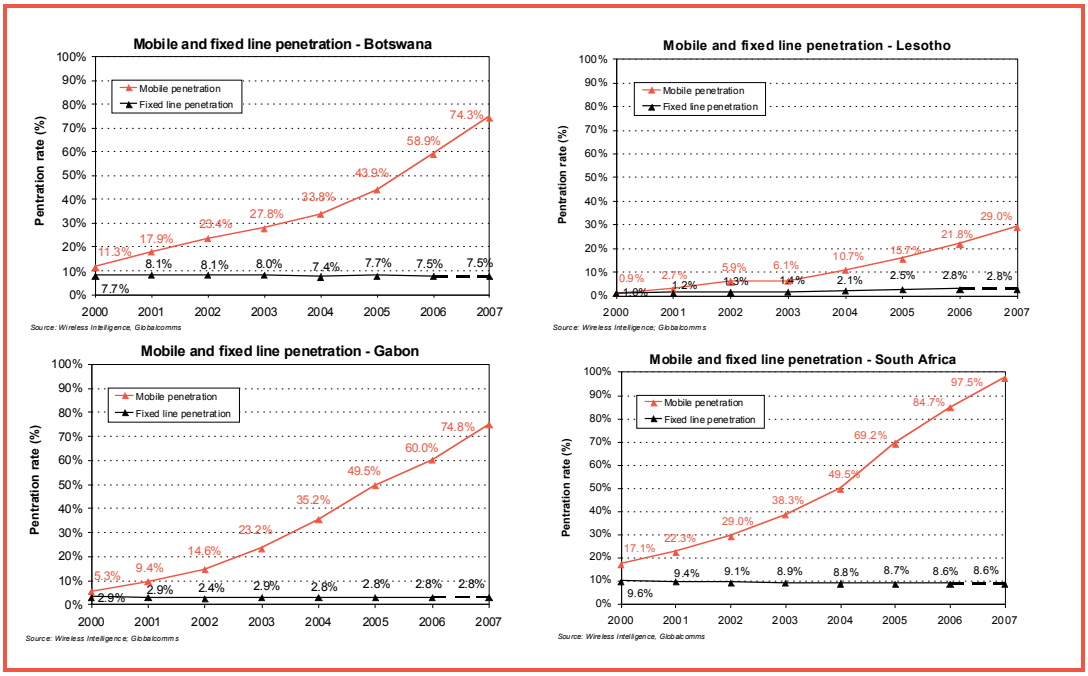


Figure 9: Mobile and fixed penetration rates in Botswana, Lesotho, Gabon & South Africa

Source: Wireless Intelligence; Globalcomms; World Bank WDI database / Frontier analysis

3.3 CONTRIBUTION OF THE MOBILE SECTOR TO THE REGION

In this section, we assess the contribution of mobile operators (and where possible the whole mobile industry) to the overall economies of the region. In particular, based on public and operator data, we consider (where available):

- mobile operator revenues;
- mobile operator capital expenditure;
- mobile operator wage bill;
- direct and indirect employment by the mobile industry; and
- total taxes paid by mobile operators.

As explained in Section 2, we present data for the maximum number of countries for which it is available. The sample sizes will therefore vary slightly and this is explained in footnotes. As the data presented relate to 2006 and, where available, forecasts have also been provided. (At the time it was provided, 2007, data was not yet available).

3.3.1 Mobile operators' revenue

In 2006, mobile operators in Sub-Saharan Africa generated total revenues of $20bn[4]. Mobile operators in South Africa and Nigeria between them generated approximately 70% of this. The level of revenue indicates how much is being spent by consumers on mobile services (excluding handsets) within each of these economies.

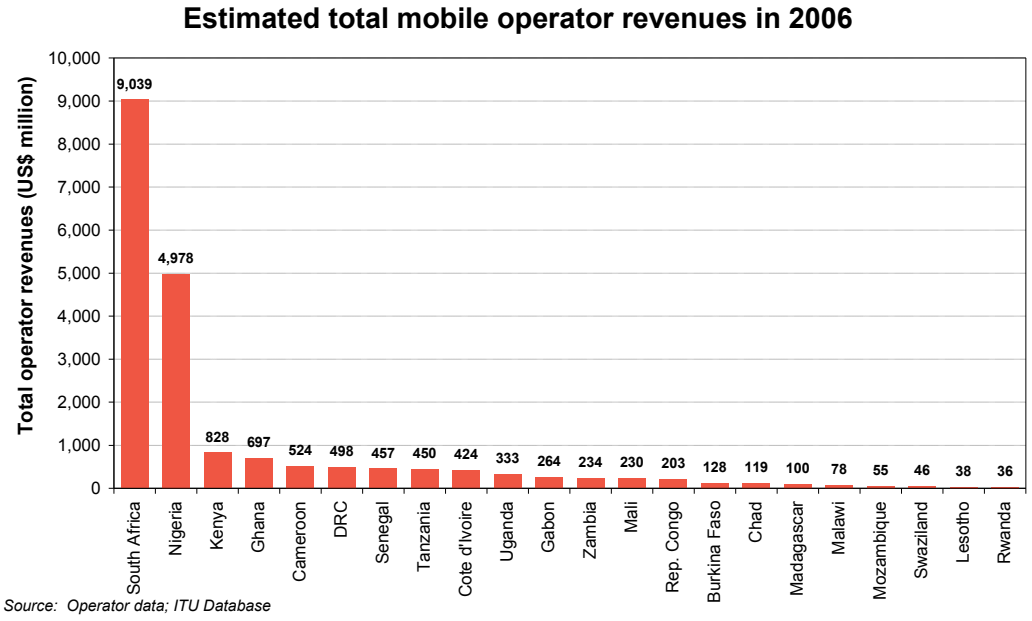


Figure 10: Estimated total mobile operator revenues in 2006, by country

Source: Operator data / ITU database

3.3.2 Mobile operators' capital expenditure

Mobile operators have invested $35bn to date in the infrastructure required to enable them to provide mobile services in Sub-Saharan Africa. As shown in Figure 11,[5] across the entire Sub-Saharan African region, they are expected to invest a further $46-52bn between 2007 and 2012. This investment activity has potential knock-on implications into other local industries, although we understand that most network equipment is imported into the region from

4 Due to data availability, this estimate is based on data from 22 operators, representing 92% of total connections in our sample. Note that these revenue figures are assumed to be net of all consumer taxes collected by the operators.

5 The investment figures are GSMA estimates.

overseas. Over this period, mobile penetration rate is expected to increase from 17% to between 31% & 35%[6].

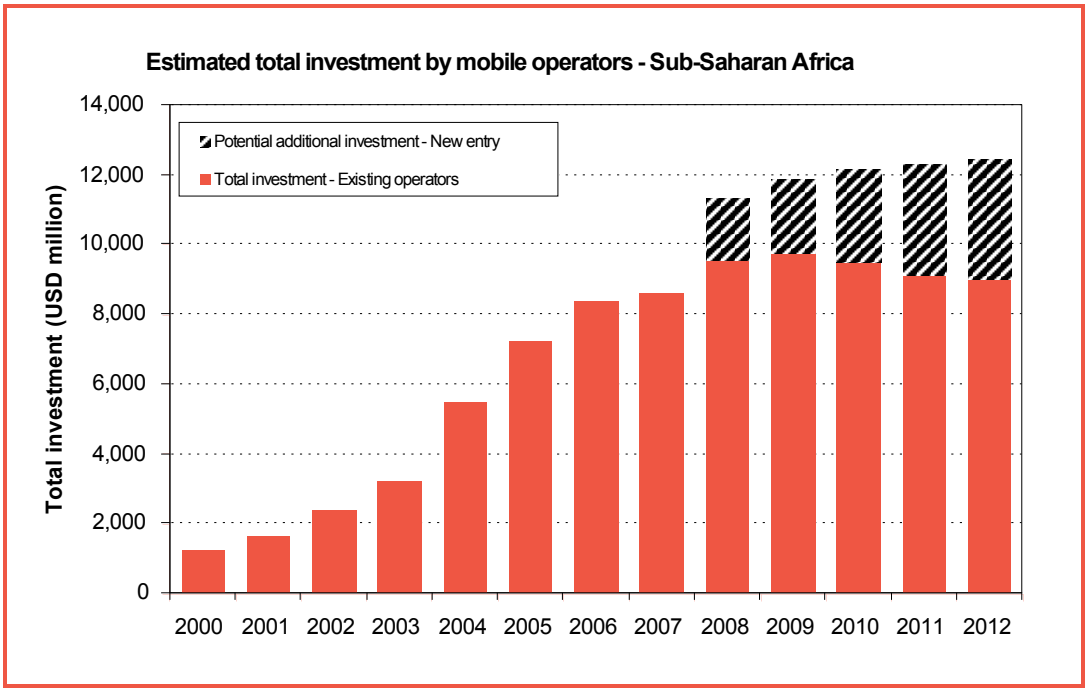


Figure 11: Estimated historic and projected investment by mobile operators

Source: MTN, Celtel, Vodacom & Orange investment data / Frontier analysis

3.3.3 Mobile operators' wage bills

During 2006, mobile operators in the region paid nearly US$ 900 million in wages[7]. Of this, approximately 68% was incurred by mobile operators in South Africa and Nigeria. This indicates the contribution that the mobile operators are directly making to household incomes, and excludes wages and salaries in other parts of the mobile industry value chain (including retail activities undertaken by providers not directly employed by the mobile operators).

6 Note that although the level of investment will be a contributory factor in generating this forecast growth, other demand side factors will also be important.

7 Due to data availability, this estimate is based on 19 countries, representing 84% of total connections in our sample.

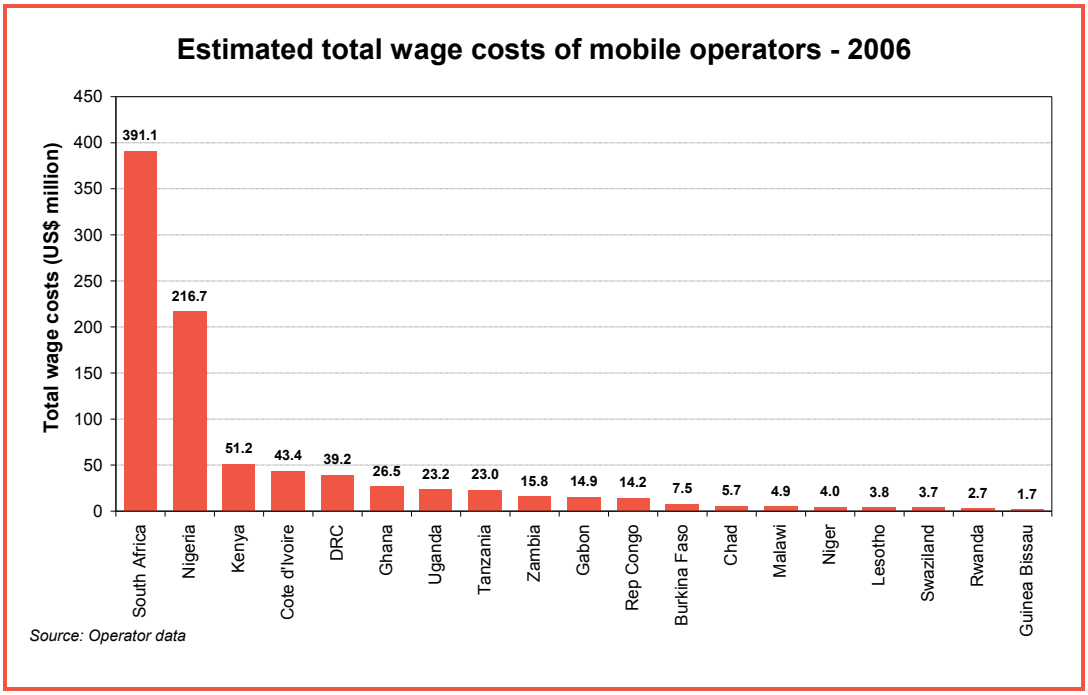


Figure 12: Estimated total wage bill of mobile operators in 2006, by country

Source: Operator data

3.3.4 Direct and indirect employment by the mobile industry

As illustrated in Figure 13 below, mobile operators in the region *directly* employ over 30,000 people[8]. Approximately 64% of these people were employed by mobile operators in South Africa and Nigeria. Note that this estimate again excludes employment elsewhere within the value chain.

8 Due to data availability, this estimate is based on 20 countries , representing 94% of total connections in our sample.

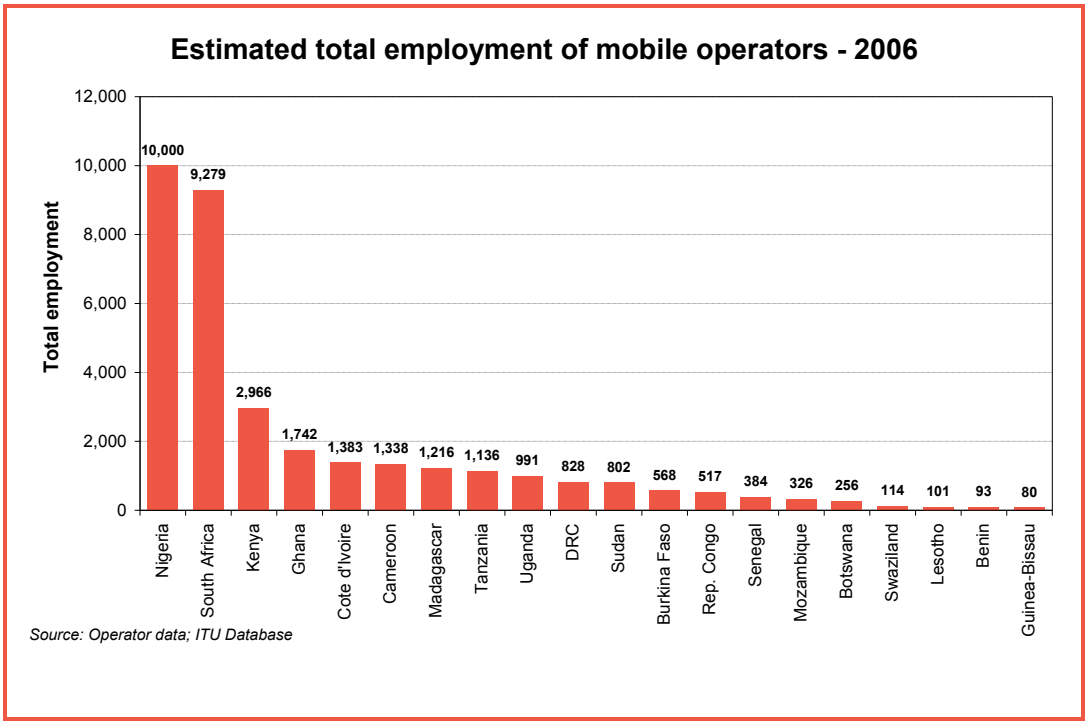


Figure 13: Estimated total employment by mobile operators in 2006, by country

Source: Operator data; ITU database / Frontier analysis

Indirect employment adds significantly to total employment by the mobile industry. In addition to the people directly employed by mobile operators, the mobile industry in Sub Saharan African provides significant indirect employment opportunities throughout the value chain. Amongst others, these are provided by:

- equipment suppliers;
- support service suppliers;
- handset suppliers; and
- air time vendors.

The size of the indirect employment effect will depend on the structure of the mobile industry in each country. Hence, we present some country-specific examples of the likely degree of the indirect employment opportunity effect, based on various public sources of information.

It is difficult to come up with a reliable estimate of the indirect employment opportunities in the mobile sector supply chain across the whole of the region. In their report "Taxation and the growth of mobile in East Africa", Deloitte quote employment figures for 2006 for a sample of four SSA countries. These results imply the following employment "multipliers".

Country	Implied multiplier (Direct & indirect employees per direct employee)
Uganda	90
Tanzania	98
Rwanda	169
Kenya	89

Table 2: Implied indirect employment multipliers

Source: "Taxation & the growth of mobile in East Africa", Deloitte & GSMA / Frontier analysis

The significance of mobile telephony in Sub-Saharan Africa

Overall, assuming these case studies are characteristic of the region, and taking an average of all implied multipliers across countries, we would estimate that total direct and indirect employment opportunities across the 20 countries for which we have estimates of direct employment could be up to 3.4m people[9].

3.3.5 Taxes paid by mobile operators

We estimate that in 2006, mobile operators in the region contributed over US$ 5 billion[10] to government tax revenues. Mobile operators in South Africa and Nigeria generated approximately 77% of this total amount. Note that the shaded data points in Figure 14 are bottom-up estimates of tax revenues (i.e. due to a lack of information on the total amount of tax paid, we have estimated the amount of each tax paid using the tax rates and estimates of the tax bases)

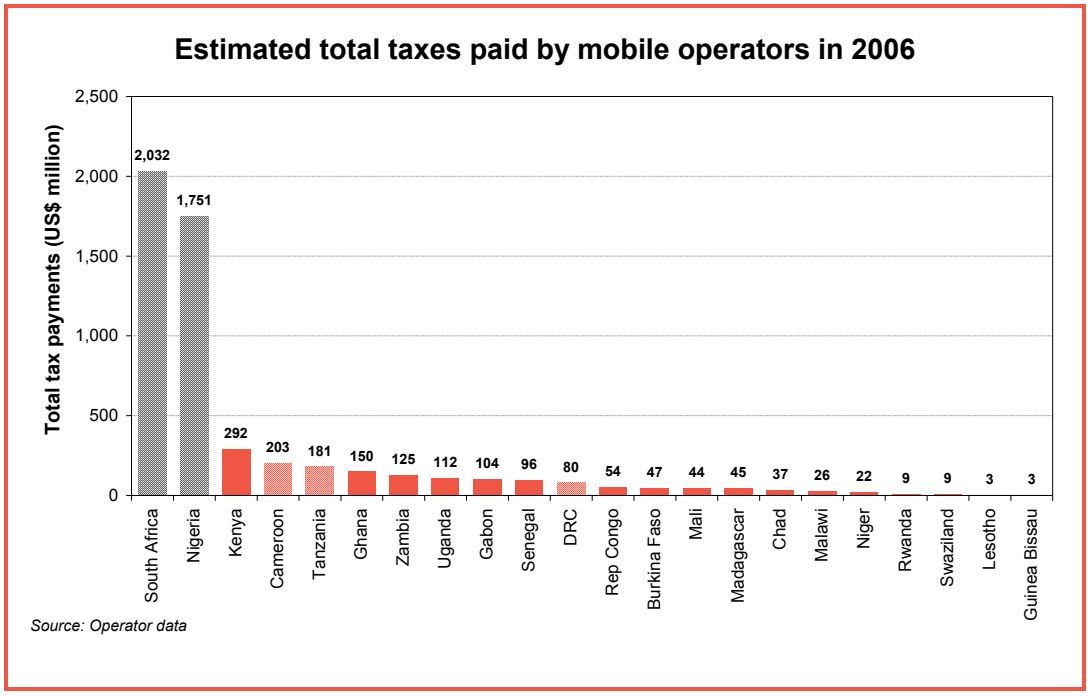


Figure 14: Estimated total taxes paid by mobile operators in 2006, by country

Source: Operator data / Frontier analysis

Figure 15 below shows total taxes paid relative to mobile operators' total revenue (measured net of consumer taxes). Total tax paid is made up of the following:

---

9 This estimate is based on an implied multiplier of 100 indirect employees/employment opportunities per direct employee – this is towards the upper end of the range of implied multipliers based on the examples shown. Using the median value of average multipliers for each country for which we have some evidence, would imply a multiplier of 89 (the range of estimates of multipliers is 75 for Nigeria, 76 for Uganda, 89 for Kenya, 98 for Tanzania, and 169 for Rwanda)

10 Due to data availability, this estimate is based on data from 22 operators, representing 91% of total connections in our sample.

- consumer taxes;
- input taxes;
- import duties on inputs;
- employment taxes; and
- corporate tax.

Given that not all of these taxes are levied on revenues, this ratio is simply a method of indicating the relative magnitude of the taxes incurred in each country, rather than showing what proportion of revenues are paid to the government in the form of tax[11]. For our sample, the ratio of total tax payments to operator revenues averaged 30%[12].

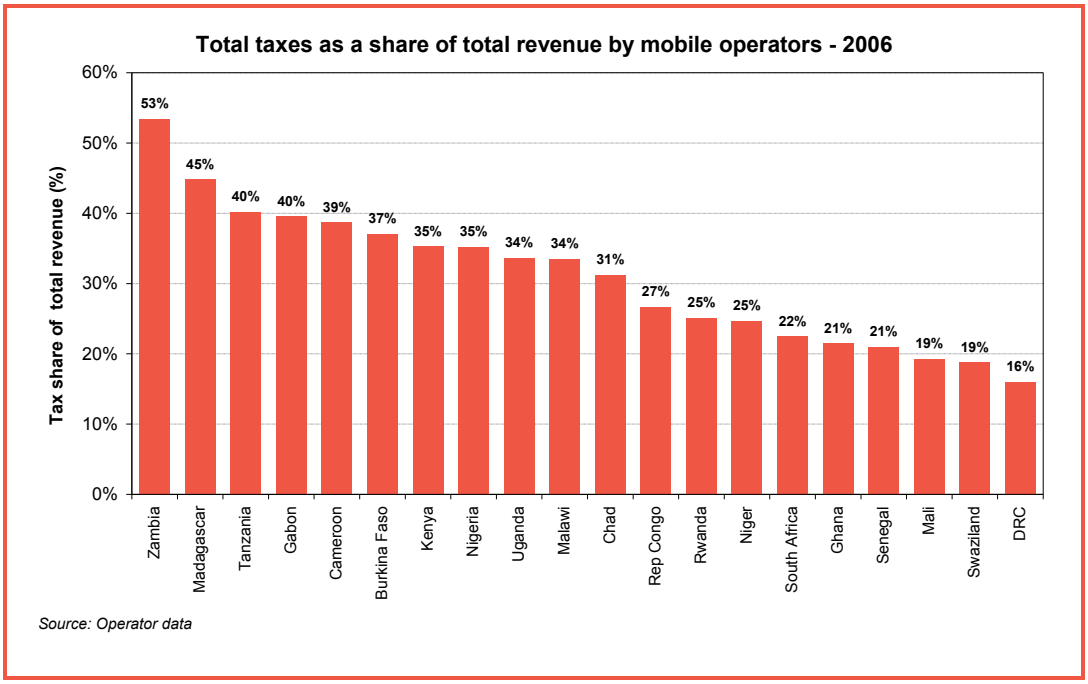


Figure 15: Total taxes paid relative to total operator revenue in 2006, by country

Source: Operator data / Frontier analysis

In all countries, taxes paid by the mobile operators are an important source of government tax revenue. Figure 16 below shows total tax payments by mobile operators as a proportion of total government tax revenues in each country for which data was available. Estimates of government tax revenues were sourced

11 See Figure 28 for an overview of consumer taxes as a proportion of consumer costs.

12 Due to data availability, this estimate is based on 20 countries, representing 89% of total connections in our sample.

from the IMF (IMF Article IV Consultations). For the sample of countries presented, operators contributed on average 7% of total government tax revenue.

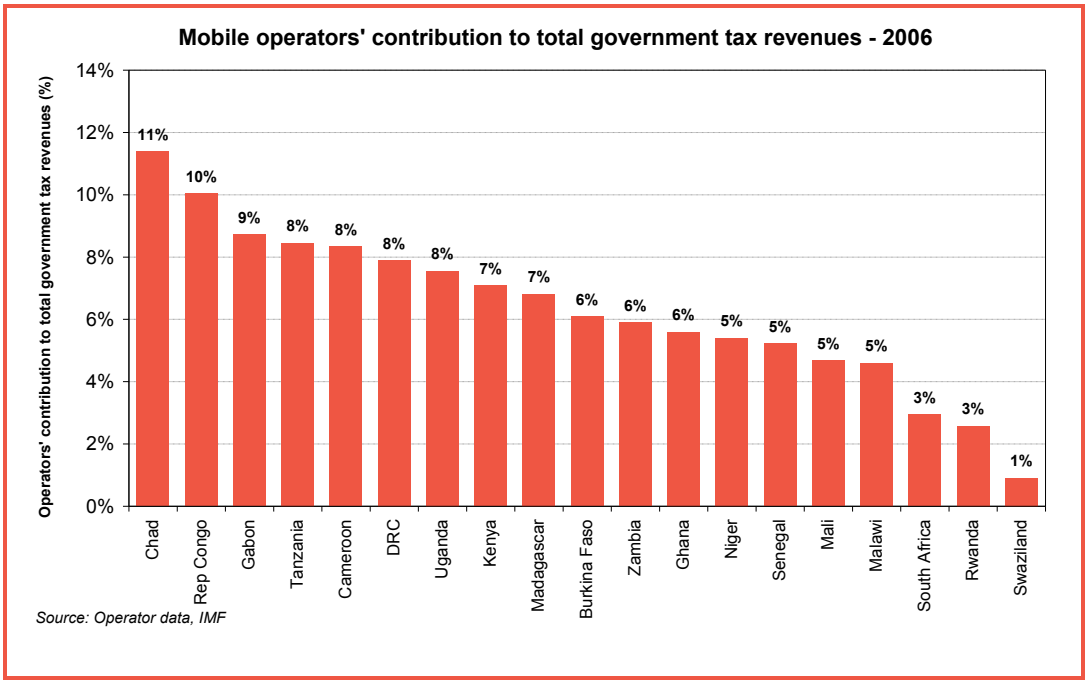


Figure 16: Mobile operators' tax payments relative to total government tax revenue

Source: Operator data; IMF / Frontier analysis

Tax rates

The main drivers of the amount of tax paid by mobile operators are the scale of the underlying tax bases and the relative level of tax rates. In this section, we present data on the combined rate of tax payable on each element of mobile services. We start with the aggregate rate of tax incurred by mobile operators on the network equipment that they purchase and then present the aggregate rates of tax incurred by consumers (and collected by mobile operators) on handsets, connections & subscriptions and airtime. Countries have been ranked by the size of the tax rate in each case.

Below, in Figure 17, we show the combined effect of taxes on equipment. The average total rate of tax levied on network equipment across this sample is 23.8%. In the Republic of Congo and Tanzania, the total tax rate on network equipment is 40% or higher. Note that we have calculated the weighted average import duty based on information provided by the operators on the level of investment they make in different types of network equipment[13] and then combined this with the VAT rate applied to imported equipment.

13 See section 2 for the tax rates on different types of equipment used to calculate this weighted average rate.

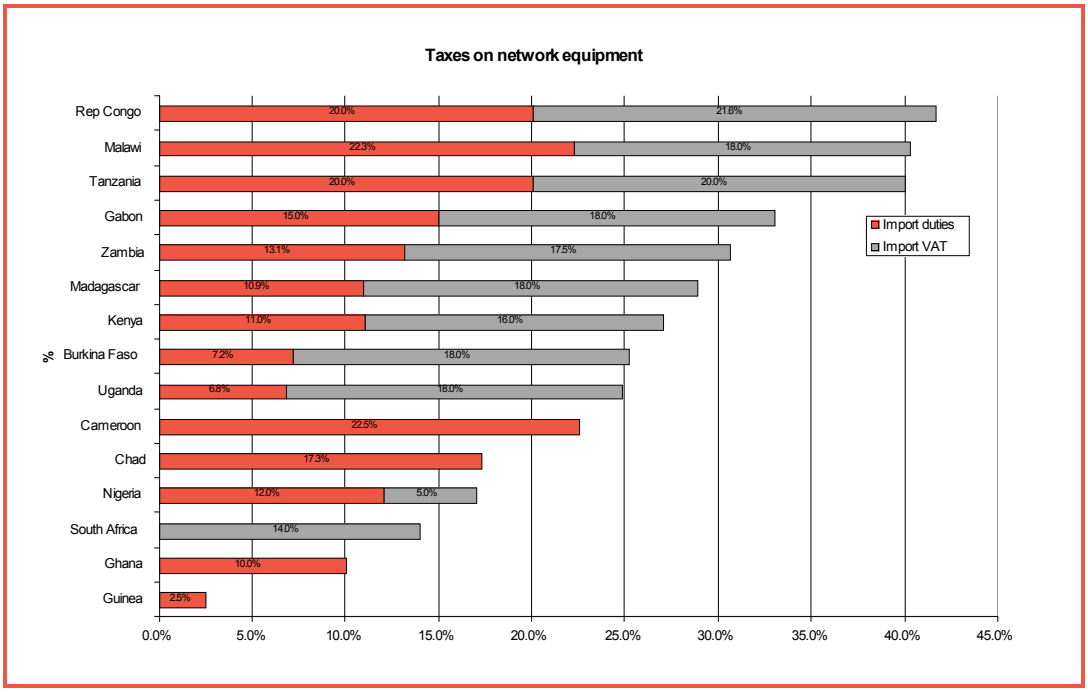


Figure 17: Total taxes levied on network equipment (import duties & import VAT) by country

Source: Celtel, Vodacom, Orange, MTN / Deloitte for the GSMA report "Global mobile tax review 2006-07" / Frontier analysis

Across our sample and as illustrated in Figure 18 below the average total rate of tax levied on handsets is 31.4%. Some countries tax more heavily than others however, and in the Republic of Congo, Cameroon, Chad and Malawi the total tax rate is estimated to exceed 45% of the retail price of a handset[14].

[14] In calculating this overall rate we have combined the proportion of import duties that we expect to be passed on to consumers with the VAT and any handset-specific taxes charged directly to consumers.

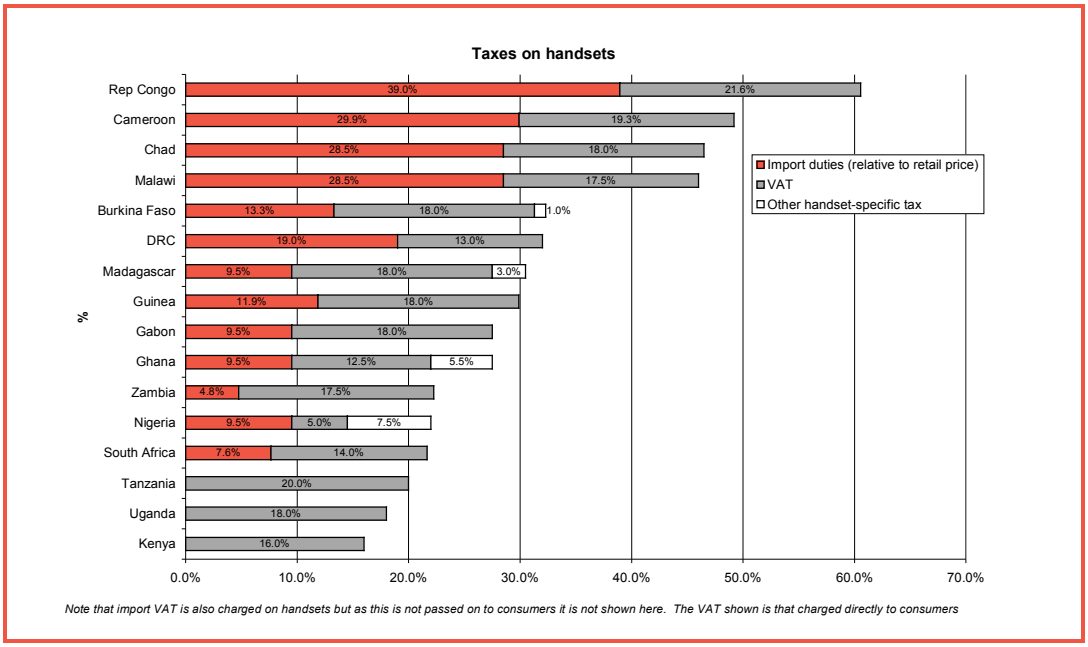


Figure 18: Total taxes levied on handsets (import duties, VAT & other handset specific consumer taxes) by country

Source: Celtel, Vodacom, Orange, MTN / Deloitte for the GSMA report "Global mobile tax review 2006-07" / Frontier analysis

In Figure 19 below, we show the combined effect of consumer taxes on connections and subscriptions. The average total rate of tax across this sample is 13.5%. In Tanzania and Cameroon taxes in excess of 18% are levied.

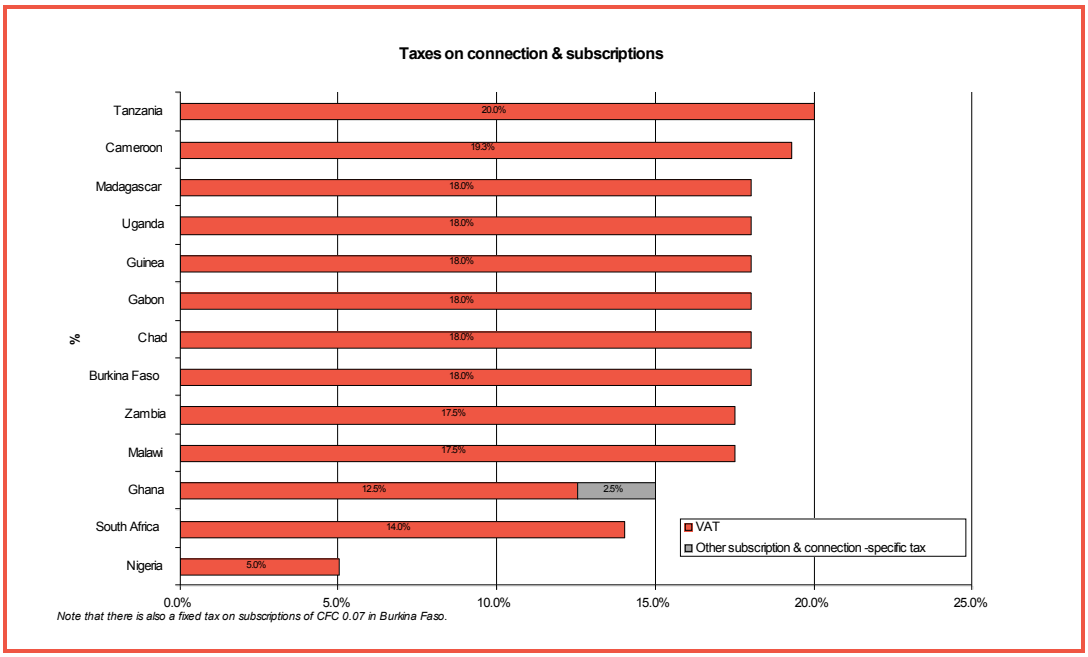


Figure 19: Total taxes levied on connections & subscriptions (VAT & other connection & subscription specific consumer taxes) by country

Source: Celtel, Vodacom, Orange, MTN / Deloitte for the GSMA report "Global mobile tax review 2006-07" / Frontier analysis

Figure 20 shows taxes levied on airtime. Across our sample, the average total rate of tax levied on airtime is 20.3%. In Uganda, Zambia, Tanzania, Madagascar & Kenya the tax rate is estimated to exceed 25% of the retail price of a minute of airtime.

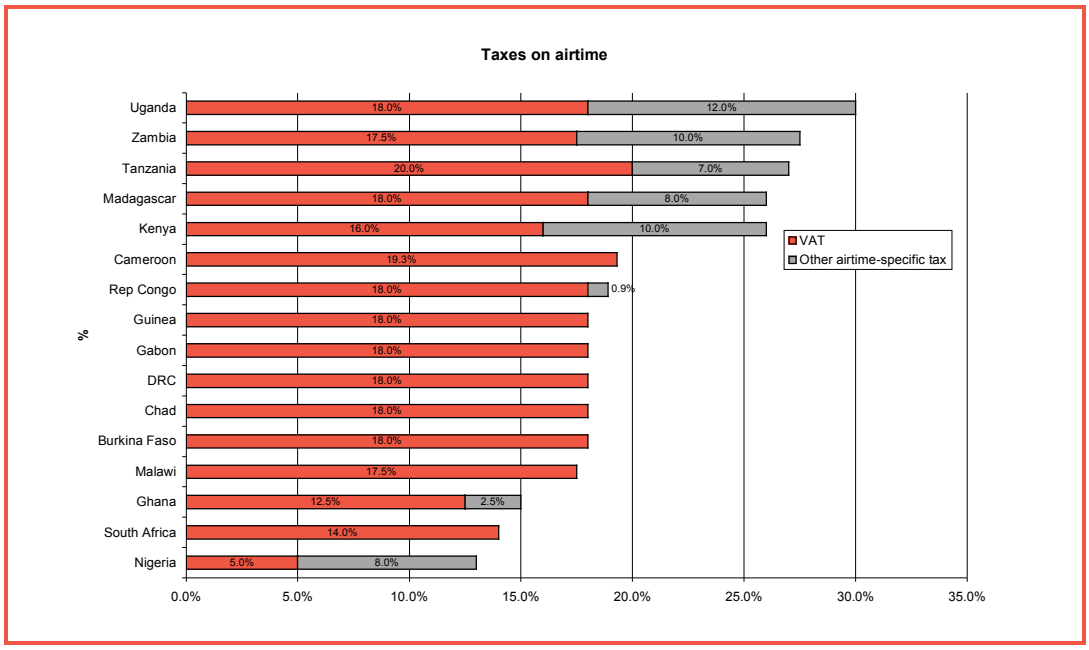


Figure 20: Total taxes levied on airtime (VAT & other airtime specific consumer taxes) by country

Source: Celtel, Vodacom, Orange, MTN / Deloitte for the GSMA report "Global mobile tax review 2006-07" / Frontier analysis

3.3.6 Case study – effect of fiscal federalism on the development of mobile telephony in Nigeria

Nigeria warrants special attention for two reasons. First, its status as the largest country in Africa by population makes it a key emerging market for mobile telephony. Indeed, based on the # of connections, it is forecast to become the largest market in the region. Nigeria is further characterised by its federal governmental structure, which has implications for the way the country's tax system is structured. We consider here the possible effects this may have on development of the mobile phone sector in the country.

The structure of the Nigerian tax system

As a federal republic, Nigeria is divided into three tiers of government: beyond the Federal Government of Nigeria (FGN) based in Abuja there are 36 states which are further subdivided into more than 700 local government areas (LGAs). One corollary of this is that Nigeria abides by a system of **fiscal federalism**: in order to preserve the independence of these different tiers of government, each is given taxing powers for certain sources of revenue. The table below presents an overview of the taxes, levies and duties relevant to the mobile phone sector:

Taxes, levies and duties payable to each level of government

Federal Government

Taxes
Company Income Tax
Education Tax
Capital Gains Tax
Withholding Tax
Value Added Tax
Personal Income Tax (PIT)
Nigerian Information Technology Development Agency

Levies
Technology Levy (NITDA)
Federal Capital Territory Administration (FCTA)
Nigeria Civil Aviation Authority (NCAA): Aviation Height Clearance Fees
Annual Operating Levy (AOL) (Payable to NCC)
Spectrum Fees (Payable to NCC)
Number Renewal

Duties
Import Duties
Comprehensive Import Supervision Scheme (CISS)
Port Levy
ECOWAS Trade Liberalization Scheme
Standard Organisation of Nigeria
Handling Charges (Payable to NAHCO)

State Government

Taxes
Personal Income Tax (PIT)
Withholding Tax

Levies
Development Levies
Base station Development Permits
Registration of Business Premises
Renewal of Business Premises
Sanitation Fees
Fees on Masts and Towers (Lagos State)

Local Government

Levies
Tenement Rates
Development Levies
Radio & T.V. License
Corporate Trade license
Bill Board and Advertisement Permit
Fencing Permit for our Cell sites
Security tax for our Cell sites
Operational Permit

Source: Celtel, Nigeria

As the table indicates, tax payments are split across three levels of government. In practice VAT accounts for a substantial proportion of the total tax incurred, meaning that the FGN receives the dominant share of total tax-based revenue. From interviews with operators we understand that approximately 90% of the tax incurred is paid to the FGN.

The contribution of the mobile phone sector to the Nigerian tax base

Our study finds the market for mobile telephony in Nigeria to be growing rapidly. The sector makes a significant contribution to both Nigerian GDP and employment and the wider Nigerian economy. Despite this growth, however, there is much potential for further expansion: in 2006 network penetration stood at less than 30%, while network coverage of the total land area amounted to just under 34%.

The characteristics of fiscal federalism

Based on stakeholder interviews we understand that complying with the current tax system imparts a high degree of administrative burden on the mobile operators. In addition, according to the Executive Vice Chairman of the Nigerian Communications Commission (NCC), the numerous taxes and levies imposed by state and local governments operators are discouraging further investments in the sector (quoted in 'Multiple Taxation is affecting GSM growth in Nigeria', '*Balancing Act Africa*' [Issue no. 299]). In particular, we understand that the fact that the FGN controls the dominant share of the tax base has resulted in some state and local governments facing shortfalls seeking to raise additional tax revenues by the use of a range of **low-yielding but administratively costly** taxes and levies. For example, from stakeholder interviews we understand that a GSM operator seeking to set up a base station in a new locality could have to pay the state government for:

- a base station development permit;
- a registration levy;
- a development levy;
- sanitation fees; and
- fees for any masts or towers erected;

and in addition to this pay the relevant local governmental authority

- development levies;
- tenement rates;
- security tax and fees for a corporate trade licence;
- a fencing permit; and
- an operational permit.

In addition to the administrative burden, we understand that the absence of streamlining in Nigeria's tax system leaves open the risk of **duplication** of certain levies and regulatory requirements. Although attempts have been made to clarify which tier of government is responsible for each tax area, some problems remain. For example, from stakeholder interviews we understand that both federal and state government agencies have been known to require separately the conduct of Environmental Impact Assessments (EIAs) for new projects.

Thirdly, the complex structure of the Nigerian tax system could deter further investment in mobile telephony simply because it makes the likely return on investment harder to calculate. From stakeholder interviews we understand that

harmonisation of most of the levies across regions would help promote investment as well as support consistency of tax rates.

Implications for further investment in Nigeria

As Africa's largest potential market, Nigeria offers significant investment opportunities for the further development of mobile telephony. However, the spread of this technology may be affected by the complex structure of the tax system for three reasons: first, it has led some state and local governments to rely on a range of low-yielding levies that are administratively costly for investors; secondly, it leaves open the risk of duplication of certain levies and regulatory requirements; and thirdly it may deter investment by making opportunities in new localities harder to identify and evaluate.

Breakdown of tax payments

Figure 21 below presents an analysis, based on our 'bottom-up' tax calculations, of the expected breakdown across our sample, of total taxes by type of tax.[15].

Based on this analysis, we estimate that VAT currently forms the largest part of total tax payments. Import duties (on equipment and handsets) and corporate tax together are estimated to account for around half of taxes paid. By 2010, VAT and other consumption taxes are together expected to account for more than half of total tax payments.

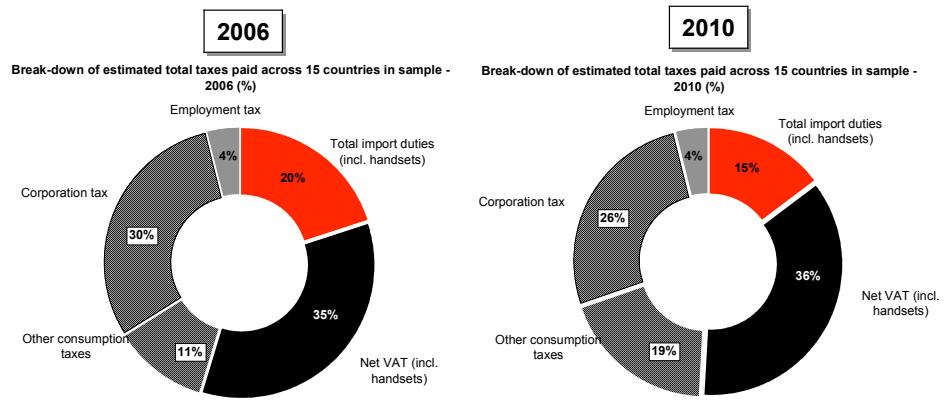


Figure 21: Analysis of total taxes paid by type across 15 SSA countries, in 2006 & 2010

Source: Frontier analysis

15 Note that these estimates are based on data from 21 operators, representing 83% of total connections in our sample. We have had to assume that employment taxes remain a constant proportion of total taxes paid. See Annex 2a for a definition of "Net VAT (incl handsets)". In addition, we have projected these calculations forward to 2010, on the assumption that tax rates remain unchanged.

There is significant variability across the sample of countries in terms of the breakdown of tax payments – see Figure 22 below. However, as explained above, due to the difficulty of estimating the actual amounts of different types of taxes paid by mobile operators, the exact proportions cannot be known with certainty.

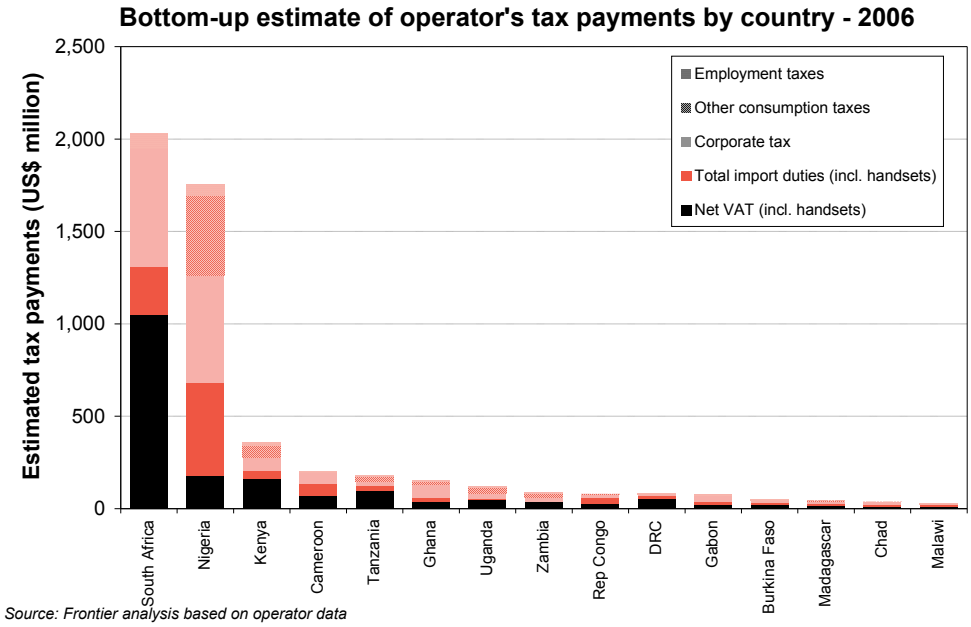


Figure 22: Estimated tax payments by tax in 2006, by country

Source: Frontier analysis

Using forecasts of the variables which underlie the relevant tax bases and assuming that tax rates remain constant, we have attempted to predict how certain tax payments made by mobile operators might evolve over time. Figure 23 below shows in the form of indices (where 2006 = 100) from 2007 to 2010 the amount of:

- import duties (including handsets);
- the net amount of VAT submitted; and
- other consumption taxes.

The pie chart below this indicates that in 2006, these three types of taxes made up approximately two thirds of the total amount of tax paid.

Overall, little change in import duties is expected (as annual investment is not expected to increase significantly), while VAT and other consumption taxes are expected to increase substantially in absolute terms, as usage of mobile telecommunications services grow. Net VAT is expected to increase by more

than 50% and other consumption taxes are expected to more than double. This reflects that fact that the number of connections is expected to continue to grow.

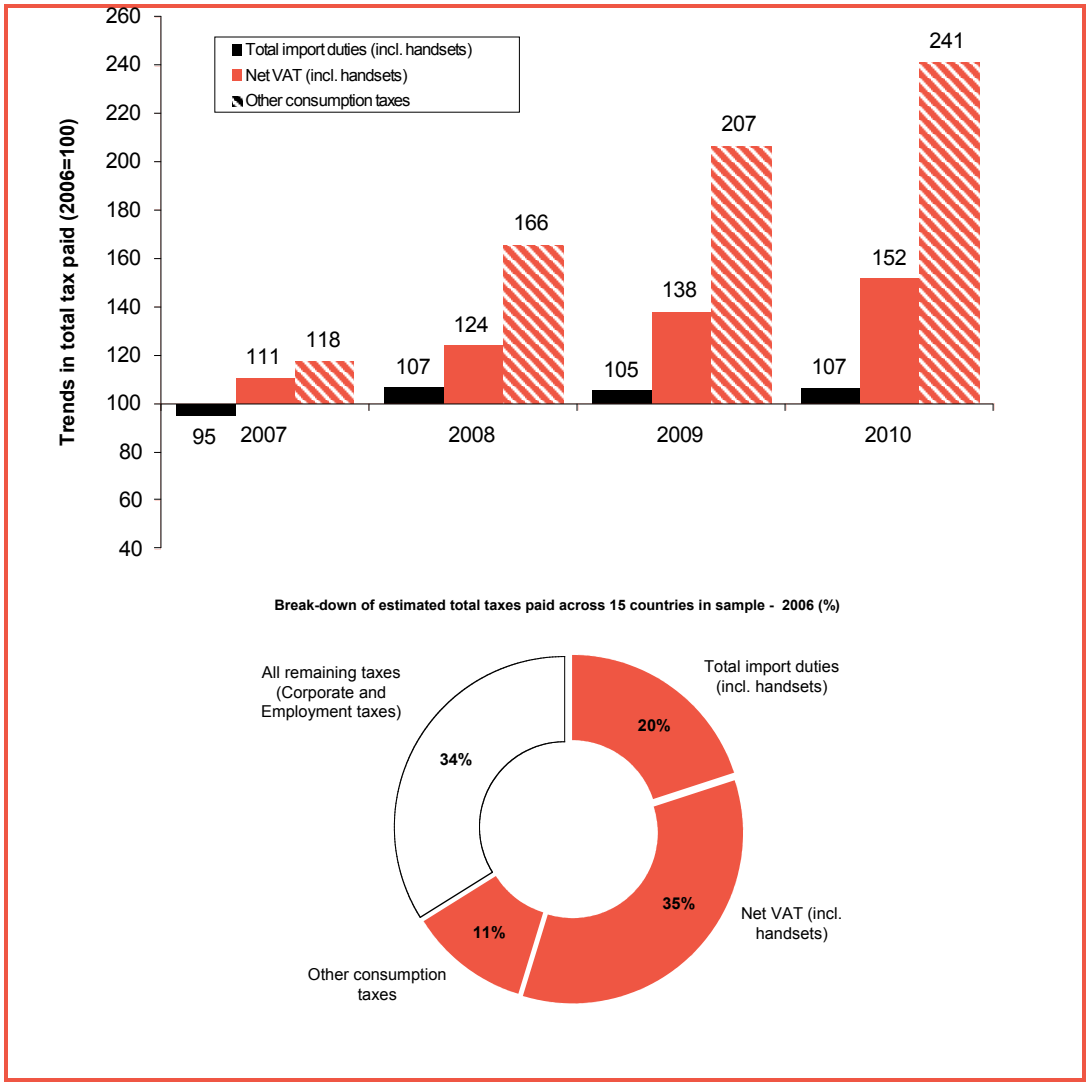


Figure 23: Forecast trends in main types of tax payment, 2007 - 2010 / Relative size of tax payments in 2006

Source: Frontier analysis

3.4 ECONOMIC IMPACT OF THE MOBILE INDUSTRY

In order to estimate the overall economic contribution of the mobile industry to the economy, it is important to look beyond the contribution made by the mobile operators. We have therefore calculated:

- The combined value added of both the operators and the other players in the mobile value chain (including upstream companies, such as equipment manufacturers and downstream handset & airtime vendors) ("the direct and indirect effect").

- The potential impact on the wider economy ("the wider economic impact").

We have sought to estimate the scale of both of these factors. The diagram below illustrates our approach.

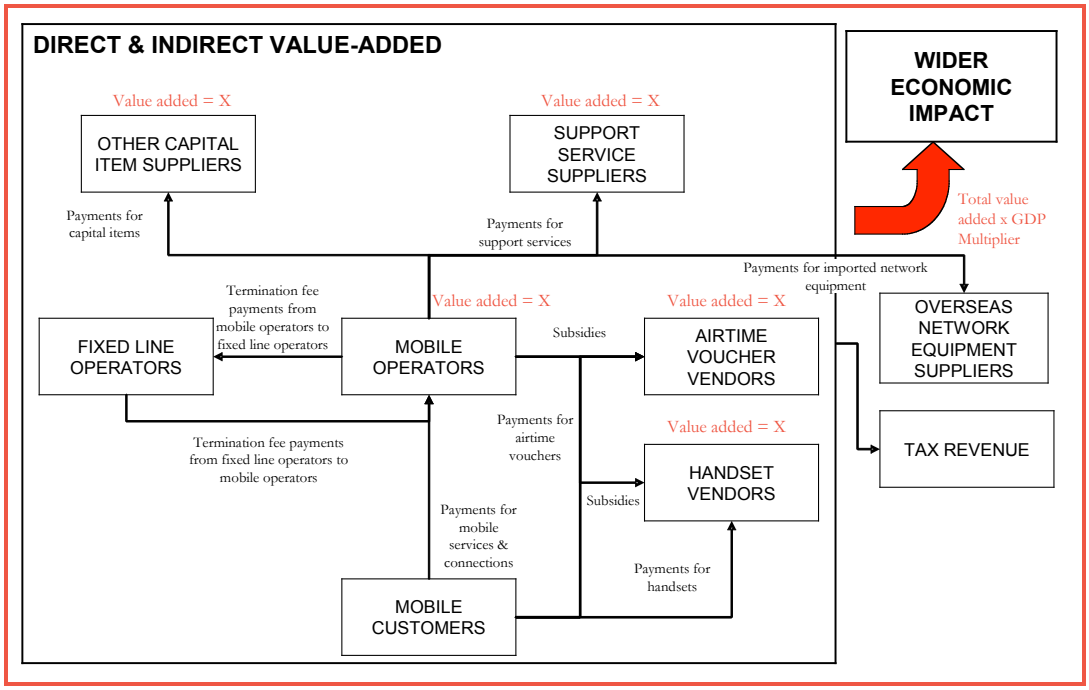


Figure 24: Diagrammatic representation of tax simulation model

Source: Frontier analysis

3.4.1 Determining the direct and indirect effect

Due to data constraints, we have applied a simplified approach to estimating the overall value added, based on mobile operator revenues. That is, we have calculated total value added (direct and indirect) as:

Operator revenue less taxes paid by operators less capital expenditure

This captures the domestic value added of the operators and the upstream industries because:

- it excludes the part of operator revenues which are paid to the government in tax;
- it excludes the part of operator revenues which are paid to overseas equipment suppliers (assuming that the majority of operators' investment represents such payments);[16]
- it includes any revenue which is paid to upstream industries; and

16 Some part of capital expenditure may include payments for software, network maintenance, etc. which are likely to be provided locally. This would mean that our estimate of value added could be slightly understated.

- it includes the revenue generated from sales of airtime vouchers to retailers.

It should be noted though that the value-added of handset vendors is not estimated separately. As a result of this, we expect that the overall effect is likely to be underestimated.

3.4.2 Determining the wider economic impact

In order to estimate the wider economic impact of the mobile industry, we have estimated a GDP multiplier for each country and then used this multiplier to determine the wider reaching effect of the combined direct & indirect value added of the mobile industry.

The wider economic impact captures the fact that a proportion of the wages paid to direct and indirect employees in the mobile industry will be spent on domestically produced goods, thus stimulating further economic activity throughout the economy. The multiplier indicates the final economic impact of the entire value chain, measured relative to the direct & indirect contribution that it generates[17].

It is important to note that for a range of reasons, the value of the wider economic impact should be treated with caution. Firstly, if the mobile industry did not exist then it is unlikely that the wider economic impact would also not exist. Rather, the resources employed in the mobile industry are likely to be re-employed elsewhere and would therefore continue to make a contribution to GDP. Secondly, the inputs required to estimate a reliable multiplier consistently are often not available at a country level.

We have, however, estimated the potential wider economic impact of the mobile sector in 13 countries within the region, including both South Africa and Nigeria. These results are presented in Figure 25 below, which shows the combined direct and indirect value added of the entire mobile sector, and the wider economic impact this generates in each of these countries.

17 See Annexe 3: Calculation of the multiplier for more details on how the multipliers were calculated.

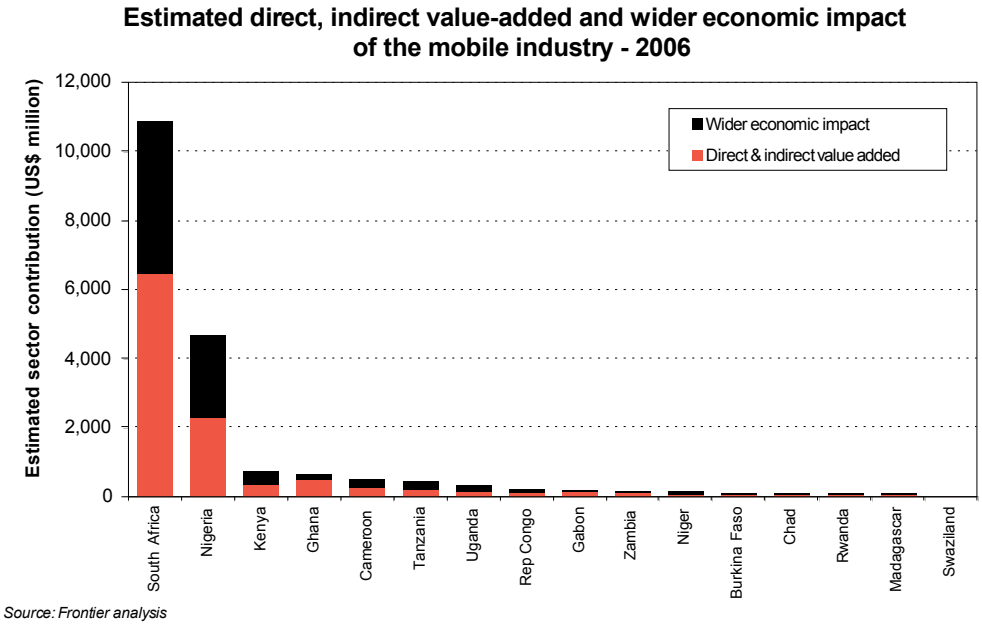


Figure 25: Estimated overall economic impact of the mobile industry

Source: Frontier analysis

As shown below in Figure 26, the economic impact of the mobile industry relative to GDP averages 3.9% across our sample. However, as our estimate does not include an allowance for the wider productivity gains which could be attributed to mobile use and (as mentioned earlier) also excludes the value-added generated by mobile phone vendors and domestic capital expenditure, it is likely to understate the full effect.

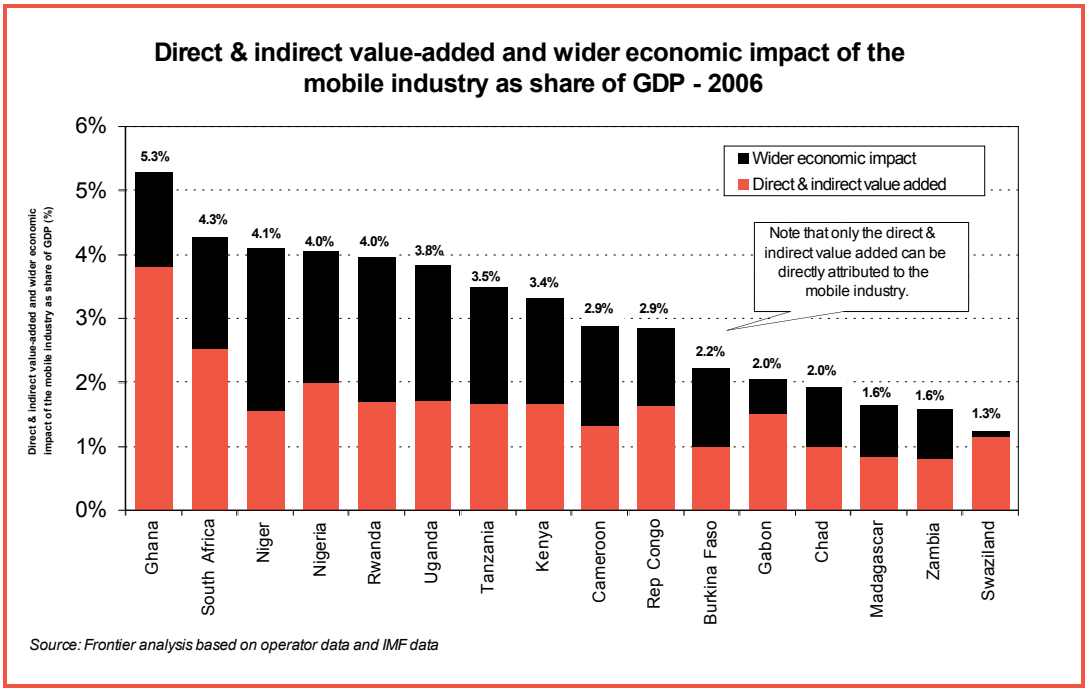


Figure 26: Estimated overall economic impact of the mobile industry relative to GDP

Source: Frontier analysis

3.5 PRODUCTIVITY BENEFITS

Figures previously published by the GSMA in collaboration with Deloitte on the overall economic contribution of the mobile sector in Kenya, Nigeria and Tanzania differ slightly from what is shown here. However those figures included estimates of the productivity benefits that would be generated and the intangible benefits for consumers.

Deloitte use the results of studies by McKinsey on the productivity benefits of mobile phones in other countries and the results of interviews with local operating companies to determine what the productivity gains would be. They then attempt to estimate the absolute economic benefit in Kenya, Nigeria and Tanzania by assuming that this gain affects all "high mobility" workers within the economy who own a mobile phone.

Other previous research has found that mobile phones have generated significant productivity gains in Africa - for example, "Africa: The Impact of Mobile Phones", Vodafone Policy Paper Series, No.3, March 2005. The main benefits quoted included:

- Improving information flows between buyers and sellers of certain products (especially agricultural and commodity products) thus cutting out the "middle-man";
- Reducing travel time and costs associated with sharing information;
- Improving efficiency of mobile workers (for example those involved in repair and maintenance, or collection and delivery); and
- Improving job search and the chances of the unemployed finding employment.

A good example of a direct benefit of mobile phones in action can be seen in Uganda where the "Foodnet" service provides farmers with the current prices of agricultural produce.[18]

Therefore it seems there is evidence to suggest that mobile phones do generate wider productivity benefits across the whole of the economy, although without collecting a large amount of data about the characteristics of each of the economies in our sample it would be difficult to predict how large this effect might be.

3.6 CONCLUSIONS

The analysis presented in this section has shown that:

- The mobile industry in Sub Saharan Africa has grown at a remarkable rate and is expected to continue to do so. Across the region, mobile phone usage dominates fixed line usage.
- There is variation in the characteristics of this market across our sample of countries – South Africa, Botswana and Gabon seem to be the most advanced and exhibit very high mobile penetration rates, while in countries

18 See http://news.bbc.co.uk/1/hi/world/africa/3321167.stm

such as Guinea & Niger, a much smaller proportion of the population currently own a mobile phone.

- The mobile industry makes an important contribution to the economies in these countries in terms of generating revenues, wages and employment. The "value-added" of the entire supply chain combined with the wider economic impact this leads to, is estimated on average to be in the region of 3.5% of GDP, although this does not allow for any further productivity gains.
- Tax revenues generated by mobile operators are significant relative to other sources of tax revenues for the governments. These revenues are expected to grow going forward as a result of the continued growth of the market.

4 Expected impact of changes in current tax regimes

4.1 OBJECTIVES

In this section we consider how the mobile sectors of the Sub-Saharan African countries in our sample might react if some of the taxes faced by mobile users and mobile operators were reduced or even removed. There may be a case for reducing or removing those taxes which are mobile-specific in order to ensure that mobile services are treated fairly by the government relative to other products and services and to ensure that the development of the sector is not being hindered in any way.

If taxes on products or services sold to consumers are reduced, this is expected to affect the prices faced by consumers. If a tax on an input is reduced this is expected to affect the price of the input which will then feed through to the retail price of the products or services sold. Lower prices would stimulate demand and hence benefit both consumers and operators. In fact if the increase in demand is large enough, lower tax rates could actually result in tax revenues being unaffected or even increasing, which would be beneficial for the government.

In performing our analysis we have considered four main questions:

1. **What would be the effect of reducing or removing taxes on imported network equipment?**

   Network equipment is a major input for a mobile operator, enabling them to build and then maintain the mobile network. We understand that all network equipment is imported and therefore in many countries is subject to import duties and potentially import VAT. As network coverage is still growing in SSA, taxation of the equipment required to expand the network could potentially be slowing the pace of this investment.

2. **What would be the effect of reducing or removing taxes on imported handsets?**

   All handsets are imported and therefore could be subject to import duties and import VAT. We understand that most operators do not sell handsets and it is specialist handset vendors that sell the majority of mobile phones in Sub-Saharan Africa. The cost of handsets, if too high, will tend to act as a barrier to entering the market as it represents a large proportion of the cost of "ownership" which must be incurred in order to participate in this market[19].

19 We are aware of schemes used in Africa, where mobile handsets are used as 'payphones', such as the "community service phone schemes" in South Africa. However we assume that the majority of handsets are used privately.

3. **What effect would reducing or removing taxes on airtime have?**

In all of the countries in our sample, pre-pay mobile services dominate post-pay mobile services and therefore most consumers are dependent on airtime vouchers. These vouchers are sold by operators to specialist vendors who then sell them on (at a small mark-up) to mobile users. In some countries only VAT is levied on the sale of airtime vouchers, while in others mobile specific taxes have also been introduced.

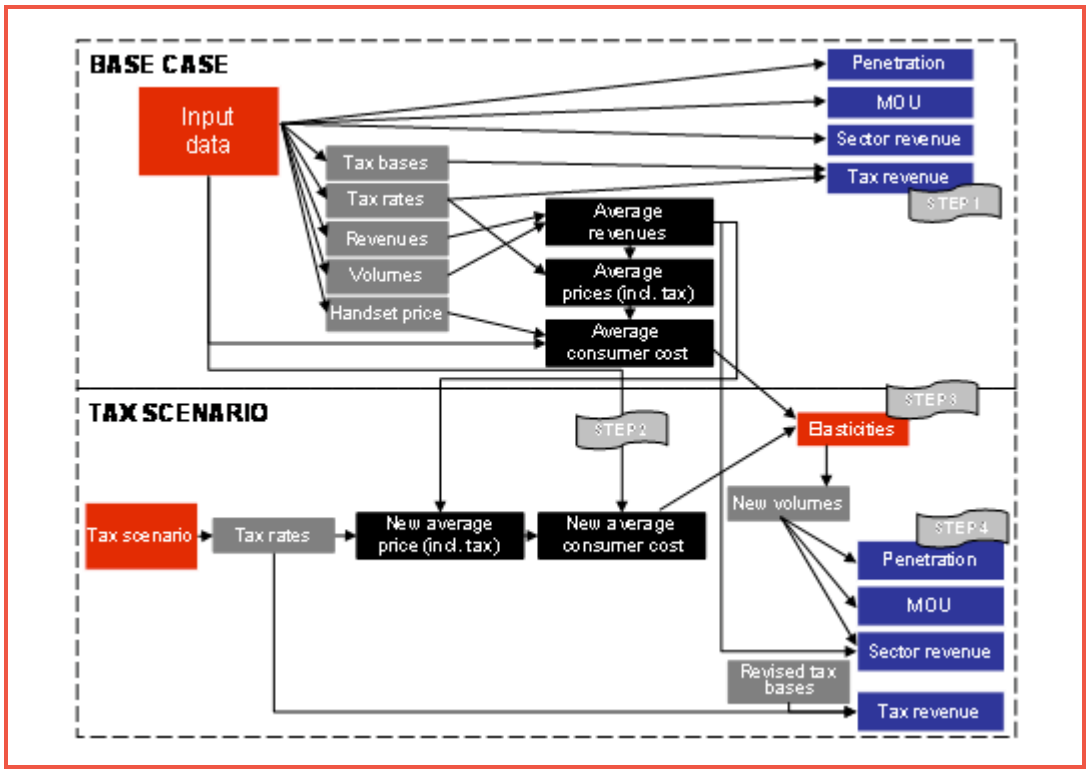
4. **"How could the national tax structures be altered to foster greater affordability and availability of mobile services?"**

In order to address this, we have considered which taxes have the most detrimental impact on penetration and then tested what would happen if they were reduced or removed.[20]

4.2 APPROACH

4.2.1 Basic model

The analysis has been undertaken using a tax simulation model. This is a stylised bottom-up model of the mobile industry which has been populated with data for each country and can be run under different taxation scenarios. Figure 27 shows how the model works.



20 As with any simulation modelling, it is important, when interpreting the results of this analysis, to take account of the limitations of the forecast. These are set out in Annexe 7 of this report.

Figure 27: Diagram of Tax Simulation Model

Source: Frontier

The tax model determines the impact of tax changes on the mobile industry in four steps (see diagram above and also see "Modelling approach" in Annexe 2: Tax simulation modelling for additional details):

Step 1 - the key industry indicators (no. of connections / penetration, minutes of usage, operator revenues and tax payments) relating to the base case, i.e. assuming no change in the current tax regime or forecast industry growth rates, are collated (or calculated in the case of tax revenue) over the period 2007 – 2010 or 2007-12.

Step 2 - the current average costs to the consumer of mobile services and the revised costs, due to the changes in both input and output taxes inherent in each proposed tax simulation scenario, are determined[21]. Note that we have consolidated the price information into a cost of "ownership" for the "average" consumer and the cost of "usage" for an "average" consumer.

- "Ownership cost" – is made up of
  - the cost of buying a phone spread over its life (normally 2 – 3 years);
  - the cost of connection, spread over the expected length of time with one operator (determined by the average market churn rate); and
  - the cost of subscription weighted by the proportion of post-pay subscribers.
- "Usage cost" - reflects the average per annum cost of the average number of minutes used by a consumer.

Below we set out the proportion of ownership costs and usage costs which are represented by consumer taxes. Any change in consumer taxes will directly affect the amount of tax paid by consumers, while any change in input taxes will affect the underlying prices.

21 We have assumed that tax changes are fully passed through to consumers, which implicitly implies that markets are competitive. Whilst we have not assessed the degree of competitiveness in individual markets, we note that the demand elasticities used in our model may be relatively conservative (see section 4.3) and so overall the impact on demand of a change in taxation may not be overstated.

Figure 28: Proportion of ownership cost and proportion of usage cost represented by consumer taxes

Source: Frontier analysis

Step 3 - the resulting impact on the demand for mobile services is estimated based on assumptions about how sensitive demand for "ownership" and demand for "usage" are to their respective prices and to each other's price. That is, we measure the proportionate change in the price of ownership between the base case estimate and the tax scenario estimate and the proportionate change in the price of usage. The aim is to isolate the effect of adjusting a tax or taxes on the final composite prices faced by the consumer in order to then determine how consumers might respond. This sensitivity is measured by the magnitude of the relevant elasticities of demand. The following text box describes the elasticities used in our analysis.

Expected impact of changes in current tax regimes

4.3 DEMAND ELASTICITIES

Our elasticity estimates were sourced from a paper which summarised various studies on the elasticity of demand for mobile telecommunications services in certain developed countries. The range for each of the elasticities required to operate our model, based on the results presented in "Review of price elasticities of demand for fixed line and mobile telecommunications services", August 2003, are shown below[22]:

ELASTICITIES	Own price	Cross-price
Ownership	-0.06 to -0.54	-0.13 to -0.50
Usage	-0.09 to -0.80	-0.10 to -0.50

In addition, we noted the elasticities estimated in "Taxation and the growth of mobile in East Africa" by Deloitte & the GSMA:

ELASTICITIES	Kenya	Tanzania	Uganda
Own price - usage	-0.96	-0.84	-1.05
Cross-price - ownership	-0.4	-0.4	-0.4

In interpreting the results, the values we have used in our analysis were influenced by two factors.

Firstly, the fact that we would have to apply these elasticities to a group of developing African countries. The lower GDP p.c. in our sample of SSA countries would lead one to expect that demand for mobile ownership and usage would be relatively more sensitive to changes in prices, and this is in line with the fact that the own-price elasticity for usage estimated by Deloitte's in Kenya, Tanzania & Uganda, as reported above, are absolutely higher than the equivalent elasticities stated in "Review of price elasticities of demand for fixed line and mobile telecommunications services", August 2003. In a country where consumers are less affluent, the cost of mobile services may represent a larger proportion of household income and therefore a change in prices may lead to a more significant change in demand.

The second issue is that the grey market for handsets is likely to be a relatively significant part of the overall market in our sample of SSA countries. In contrast this would tend to make the own and cross-price elasticity of demand for ownership with respect to changes in price (where those price changes are driven by changes in taxation) less sensitive, because the price change would not affect those using the grey market.

On balance therefore, we have chosen the higher end of the elasticity ranges provided by the summary paper as our central elasticity estimates, although

22 Note that the cross-price elasticity of ownership is shown relative to a change in the price of usage and the cross-price elasticity of usage is shown relative to a change in the price of ownership.

recognise that these may be relatively conservative compared to some estimates of demand elasticities in Sub Saharan Africa[23]. The elasticity estimates used in our tax simulation model are shown below:

ELASTICITIES	Own price	Cross-price
Ownership	-0.54	-0.50
Usage	-0.80	-0.50

In view of the relative uncertainty surrounding the appropriate values of the elasticity estimates, we have performed analysis of the sensitivity of the results of our tax simulation model to changes in the magnitude of our elasticity estimates. See section 4.10 for more details.

4.4 TAXES ON EQUIPMENT

In order to model the reduction of import duties on equipment, we have had to make assumptions about how these taxes are recovered by operators from their consumers and hence how prices and therefore the cost of ownership and usage would react if these taxes were removed. Our modelling approach is described below.

Taxes on network equipment are assumed to be recovered over the life of that equipment in the same way that the investment in the equipment would. If an import duty on equipment is removed, there is no need to recover the annualised amount of the cost that operators would otherwise incur, therefore less revenue needs to be generated and so prices can be reduced. We assume that the proportion of operator revenue associated with each element of mobile services (i.e. connections, subscriptions and usage) remains constant and therefore all prices (excluding handsets which are not sold by operators) are, to some extent, reduced. As usage generates the largest proportion of operator revenues, so the greatest impact will be on the cost of usage. The main effect of this is that in the first few years after an equipment tax is removed the effect on prices will be diluted as it is effectively being spread into the future[24].

Step 4 - each of the revised industry indicators under each tax simulation scenario are calculated. The new tax revenues for example will take into account both the change in the tax rate(s) and any offsetting demand response – i.e. some tax payments will increase due to an uplift in the underlying tax base[25] (note that

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23 See footnote 25.

24 Note that our model does not consider the demand response (in terms of changes in the amount of investment) in response to a reduction in these taxes. It is very difficult, without reliable estimates of the elasticity of investment with respect to price and details of forecast equipment prices and number of items of equipment operators plan to purchase, to determine how the level of investment would be likely to respond.

25 Due to data limitations we have not taken into account any displacement effect across the economy – i.e. we have not adjusted the new tax revenues to allow for the fact that increased expenditure on

increased penetration affects the tax bases of more taxes than increased average usage per user). Consequently, the evolution of the industry indicators over time under the Base Case and under the tax scenario can be compared in order to differentiate the effect of removing the tax from the effect of expected market developments.

The scope of the exercise implies that the model that has been used is general enough to be able to assess the impact of different tax scenarios across a wide range of countries within the data limitations present – for example the elasticities used are common across the countries. In considering the results for any individual country therefore, the interpretation should focus on the relative magnitude of the impact of different scenarios, rather than the absolute estimates of tax.

4.4.1 Extended model

Given date constraints, our basic model covers a four year period. However, we recognise this may not allow for the full effects of a tax scenario to feed through to the mobile sector. Therefore, we have rolled forward the model for four countries (Cameroon, Republic of Congo, Ghana & Malawi) so that we can consider the effect of each scenario over a ten year period to 2017. This group of countries was selected because they face relatively high tax rates.

In addition, Scenario 4 is the scenario expected to have the most significant impact on penetration. We have therefore examined the effect over the period 2007-10, and 2007-12, to assess the impact of allowing a longer period for second round effects of tax changes, which stimulate the demand for mobile services, to feed through to the estimated tax revenue raised.

In order to populate the extended models, we have had to make assumptions about trends in the input data going forward which, by their nature, are more tentative. The approach taken is described in Annexe 2: Tax simulation modelling. In all other respects the extended model works in exactly the same way as the basic model as described above.

Due to the difficulty in predicting the performance of any industry far into the future, the results of our extended model may be less robust than the basic four year model. It therefore becomes more important to consider the relative movements in the industry indicators under the tax scenario relative to the base case as generated by the extended model, rather than the absolute figures.

4.4.2 Tax scenarios

In order to address the four questions outlined in section 4.1 above, we have run the scenarios set out below:

1. Reduction in all import duties on equipment (of 50% or 100%);

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mobile services (and hence increased tax revenues) may be at the expense of expenditure elsewhere in the economy (and hence at the expense of tax revenues from these other sources). We have undertaken a sensitivity to evaluate the potential significance of displacement for our results.

2. Reduction in all import duties on handsets (of 50% or 100%);
3. Reduction in all airtime related taxes (of 50% or 100%); and
4. Removal of all "ownership" related taxes (but for VAT)

As we do not have data on every tax in every country and not all taxes exist in every country, each scenario has been applied to the appropriate subset of our overall sample of countries. In addition we have focused on determining the impact of tax changes in those countries where mobile markets are relatively less mature and hence where the positive impact of removing such taxes might have the most significant impact on the sector - as a consequence, we have excluded South Africa from our analysis. See below for the samples used to assess each of the tax scenarios.

Expected impact of changes in current tax regimes

Tax Scenario	1A	1B	2A	2B	3A	3B	4
Details	Removal of all import duties on equipment (100%)	Reduction of all import duties on equipment (50%)	Removal of all import duties on handsets (100%)	Reduction of all import duties on handsets (50%)	Removal of all air time specific taxes (100%)	Reduction of all air time specific taxes (50%)	Removal of all ownership-related taxes*
Countries included in scenario sample	Burkina Faso		Burkina Faso		Ghana		Burkina Faso
	Cameroon		Cameroon		Kenya		Cameroon
	Chad		Chad		Madagascar		Chad
	Gabon		DRC		Nigeria		DRC
	Ghana		Gabon		Rep Congo		Gabon
	Kenya		Ghana		Tanzania		Ghana
	Madagascar		Kenya		Uganda		Kenya
	Malawi		Madagascar		Zambia		Madagascar
	Nigeria		Malawi				Malawi
	Rep Congo		Nigeria				Nigeria
	Tanzania		Rep Congo				Rep Congo
	Uganda		Zambia				Zambia

Table 3: Overview of tax scenarios and country samples

Source: Frontier analysis

* Ownership related taxes include non-VAT consumption and unit taxes levied on handsets, connection and subscriptions.

In the following four sections, we concentrate on the outcomes of the extreme scenarios where the relevant taxes are completely removed (1A, 2A, 3A & 4).

4.5 EFFECT OF A REDUCTION IN TAXES ON IMPORTED NETWORK EQUIPMENT

In this section we set out the results of tax scenario 1A – removal of all import duties on equipment. Below we present the results of our basic model and in Annexe 5, the results of running this scenario through the extended model for a subset of countries.

4.5.1 Results of basic model (2007 - 2010)

The following charts display the key cross-country outputs of our basic model over the period 2007-2010 for this tax scenario.

Tax rates

Table 4 below sets out the taxes charged on different types of network equipment in each of the twelve countries in our sample[26]. Under tax scenario 1A we have modelled the effect of removing these taxes relative to keeping them the same in each of the countries shown.

Country	Average import duty - Radio equipment	Average import duty - Transmission equipment	Average import duty - Switching & core network equipment	Average import duty - Software
Burkina Faso	7.50%	8.00%	7.50%	
Cameroon	22.50%	22.50%	22.50%	22.50%
Chad	26.80%	14.20%	14.20%	39.60%
Gabon	15.00%	15.00%	20.00%	
Ghana	10.00%	10.00%	10.00%	10.00%
Kenya	10.00%	10.00%	10.00%	25.00%
Madagascar	10.00%	10.00%	10.00%	20.00%
Malawi	45.00%	5.00%	10.00%	
Nigeria	12.00%	12.00%	12.00%	
Republic of Congo	20.00%	20.00%	20.00%	20.00%
Tanzania	20.00%	20.00%	20.00%	20.00%
Uganda	10.00%		10.00%	

Table 4: Tax scenario 1A - Removal of all import duties on equipment

Effect on consumer costs

Figure 29 indicates the proportionate change in ownership and usage costs between tax scenario 1A and the base case on average over the period 2007-2010 in each country. That is, it indicates how the costs that consumers face change as a result of removing the taxes set out above. The effects are relatively small. This is due both to the assumed "pass through" mechanism (see box 4.4 above) and the level of forecast investment. As explained earlier, the effect of removing import duties on equipment is diluted because we assume that the recovery of these taxes is effectively spread over the life of the equipment. Therefore, unless

[26] These rates have either been provided directly by the major mobile operators or taken from research performed by Deloitte's for the GSMA report "Global Mobile Tax Review 2006-07"

a very large amount of investment is being made in network assets or only assets with relatively short lives are being acquired, our model will not pick up the full effect of such tax reductions. As minutes of use generate the most revenue for operators the price of usage is affected the most by the removal of import duties on equipment. As can be seen below, usage costs fall the most in Gabon, followed by Malawi, Madagascar & Tanzania. Ownership costs decline by less – the largest effect occurs in Madagascar where costs fall by only half a percent.[27]

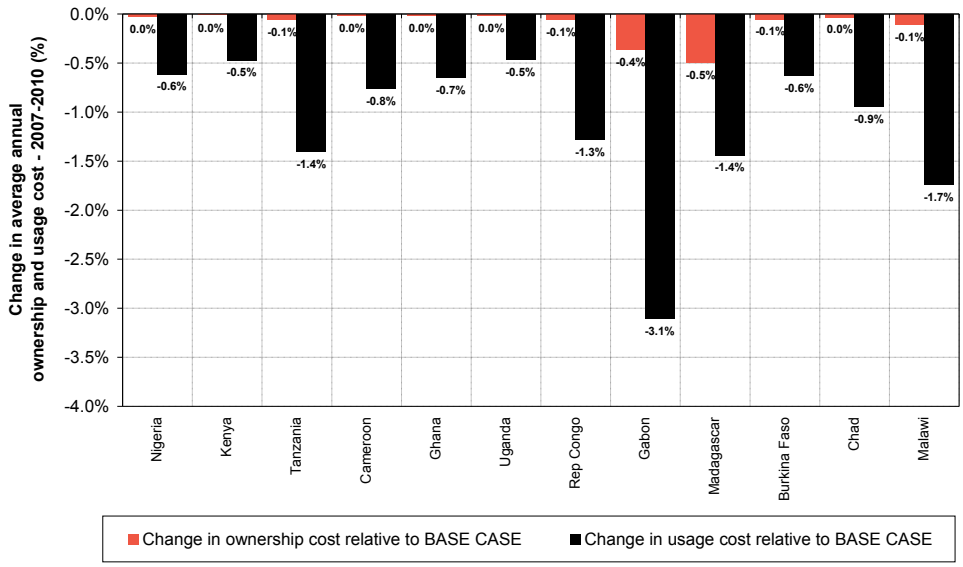

Figure 29: Change in ownership and usage costs between tax scenario 1A and the base case

Source: Frontier analysis

Effect on penetration & minutes of use

Removing import duties would appear to have limited impact on penetration because the effect on prices is relatively small. Only in Gabon is there a noticeable increase in mobile penetration (of 5 percentage points). Total minutes of use increase most clearly, in absolute terms, in Nigeria, however this is only an absolute increase of 0.9%. In Ghana, total minutes of use would actually increase by 18%.

[27] The effect on consumer costs in driven both by tax levels and the relative levels of forecast investment in all markets.

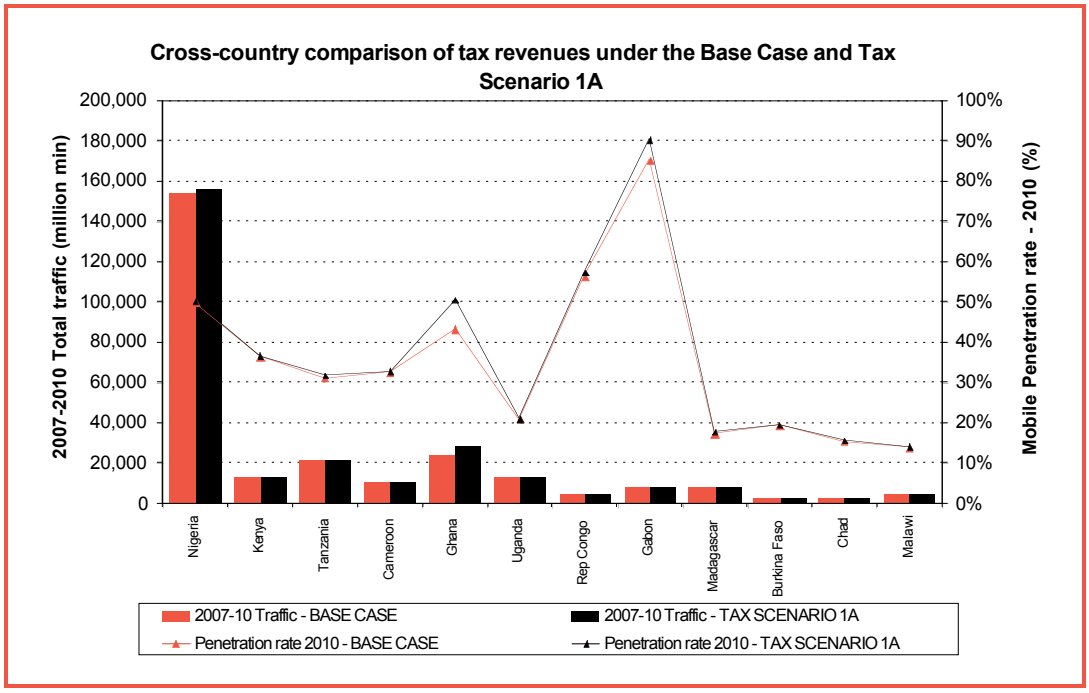

Figure 30: Cross-country comparison of total minutes of use and penetration under the base case and tax scenario 1A

Source: Frontier analysis

Effect on tax revenues

The impact on aggregate tax revenues over the period 2007 – 2010 is negative in all of the countries, to varying degrees. As explained, the demand response is small, due to the way in which this tax reduction feeds consumer prices. Therefore, penetration and usage are not stimulated enough to result in an increase in other taxes sufficient to offset the loss of the equipment import duties. The smallest reduction occurs in Kenya and Uganda where mobile sector tax revenues would only be approximately 3% lower than they would be absent the removal of this tax..

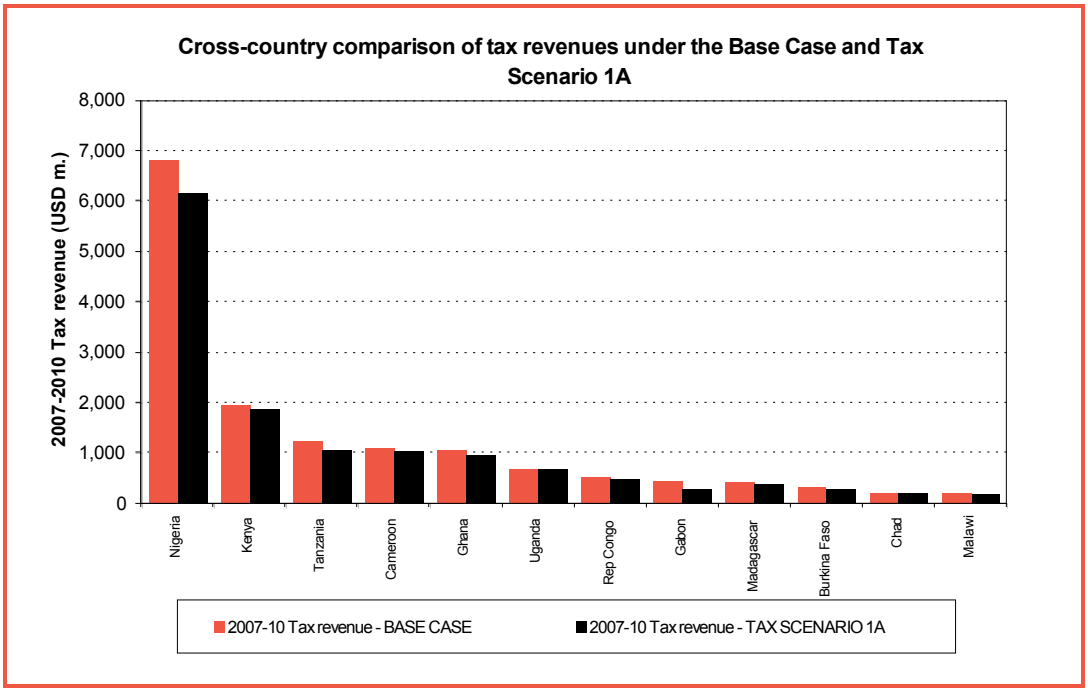

Figure 31: Cross-country comparison of tax revenues under the base case and tax scenario 1A (Removal of all import duties on network equipment)

Source: Frontier analysis

4.6 EFFECT OF A REDUCTION IN TAXES ON IMPORTED HANDSETS

In this section we set out the results of tax scenario 2A – removal of taxes on imported handsets. Below we present the results of our basic model and in Annexe 5: Selected results from extended model (2007 – 2017) the results of running this scenario through the extended model for a subset of countries.

4.6.1 Results of basic model (2007 - 2010)

The following charts display the key cross-country outputs of our basic model over the period 2007-2010 for tax scenario 2A – removal of taxes on imported handsets.

Tax rates

Table 5 below sets out the taxes charged on imported handsets in each of the twelve countries in our sample.[28] Under tax scenario 2A we have modelled, in each of the countries shown, the effect of removing these taxes relative to keeping them unchanged.

28 These rates have either been provided directly by the major mobile operators or taken from research performed by Deloitte's for the GSMA report "Global Mobile Tax Review 2006-07"

Country	Import duties - handsets	Other input taxes - handsets
Burkina Faso	14.00%	
Cameroon	31.50%	
Chad	30.00%	
DRC	20.00%	
Gabon	10.00%	
Ghana	10.00%	
Kenya		2.25%
Madagascar	10.00%	3.00%
Malawi	30.00%	
Nigeria	10.00%	
Republic of Congo	41.00%	
Zambia	5.00%	

Table 5: Tax scenario 2A - Removal of all import duties on handsets

Effect on consumer costs

Figure 32 indicates the proportionate change in ownership costs between tax scenario 2A and the base case in each country on average over the period 2007-2010. That is, it indicates how the costs that consumers face change as a result of removing the taxes set out above. The cost of a handset (spread over its expected life) forms a large proportion of the average ownership cost and therefore removing a tax which affects the retail price of a handset has a sizeable effect on the cost of ownership. The largest reduction in ownership costs occurs in Republic of Congo, Cameroon and Chad, where costs fall by more than 20%. Note that we assume that import duties on handsets are applied to the wholesale cost of an imported handset but that this cost is then passed through to the consumer.

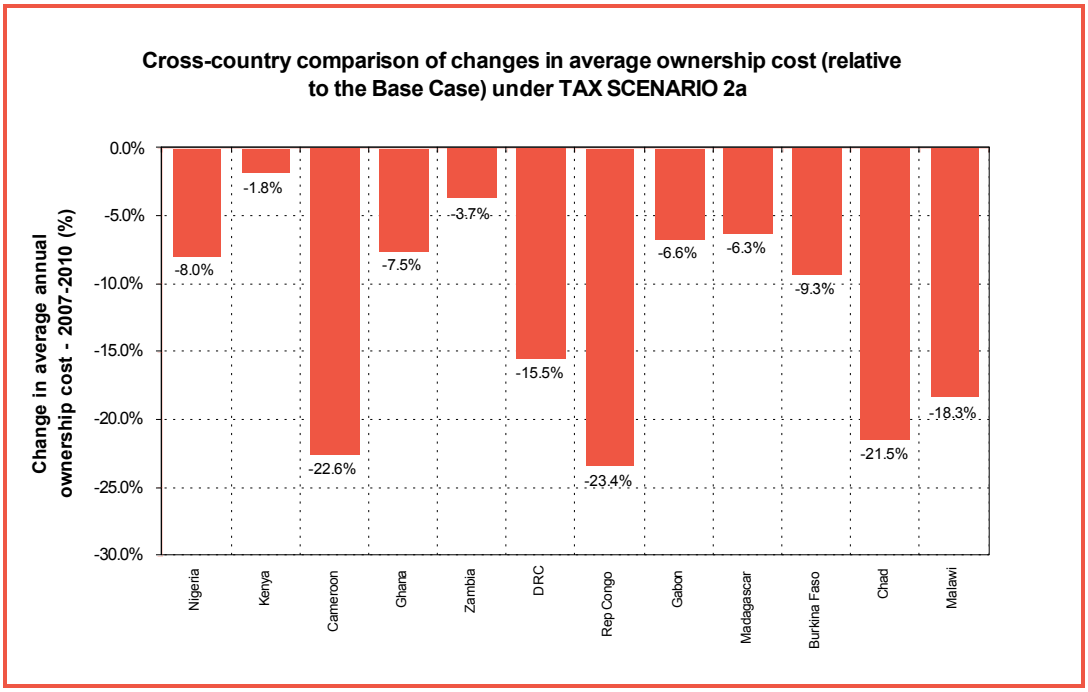

Figure 32: Cross-country comparison of change in average ownership cost between tax scenario 2A and the base case

Source: Frontier analysis

Effect on penetration & total minutes of use

Compared to scenario 1A, scenario 2A has a larger impact on penetration. In the Republic of Congo, Cameroon and Gabon, this is particularly noticeable and the increase in penetration in these countries relative to the base case ranges between 10 and 18 percentage points.[29] Total minutes of use increase most significantly in Nigeria, in absolute terms, although the proportionate change is only 12%. In Cameroon and Republic of Congo, the total minutes of use are boosted by 37 and 38% respectively and in Chad, Malawi and DRC the increase exceeds 20% in each case.

[29] For Cameroon, this represents approximately a one-third increase in penetration in 2010, compared to the base case.

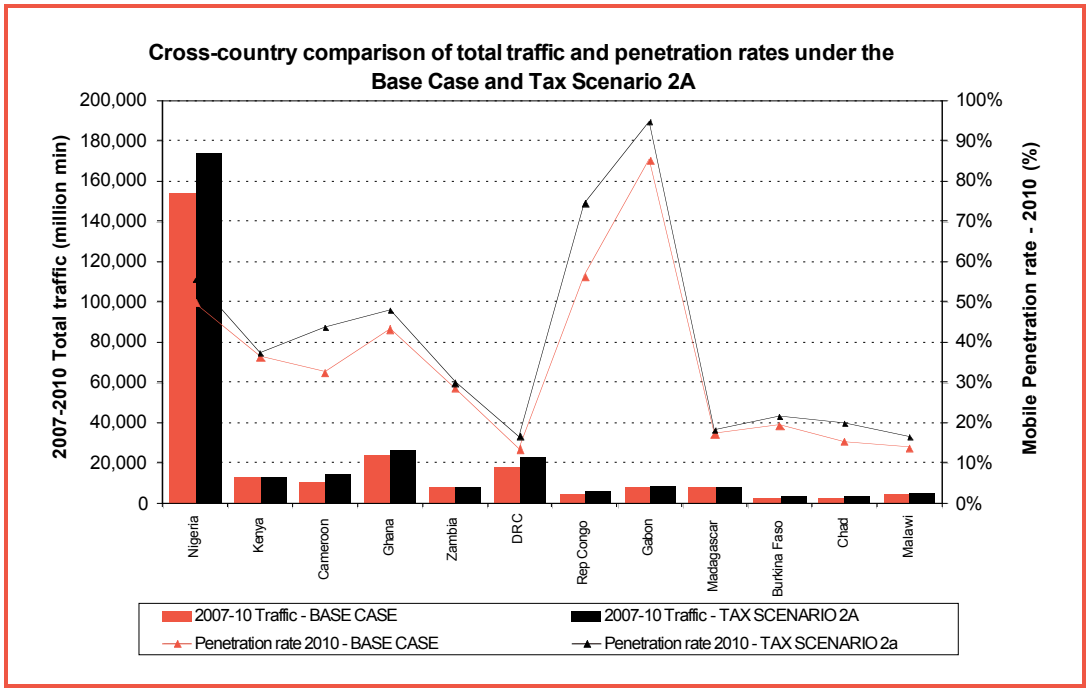

Figure 33: Cross-country comparison of penetration and total minutes of use under tax scenario 2A relative to the base case

Source: Frontier analysis

Effect on tax revenues

Overall tax revenues are affected by the relative size of the tax being removed and the additional revenue generated by the demand effect of the tax reduction. As the chart shows, in some countries this tax scenario is tax revenue neutral over the period (e.g. in Kenya) and in some cases it is somewhat tax revenue positive (e.g. in Chad, Gabon, Ghana & Zambia tax revenues from the mobile sector increase by up to 7%). We look in more detail at the results for Cameroon, where the import duty rate is relatively high in Annexe 4.

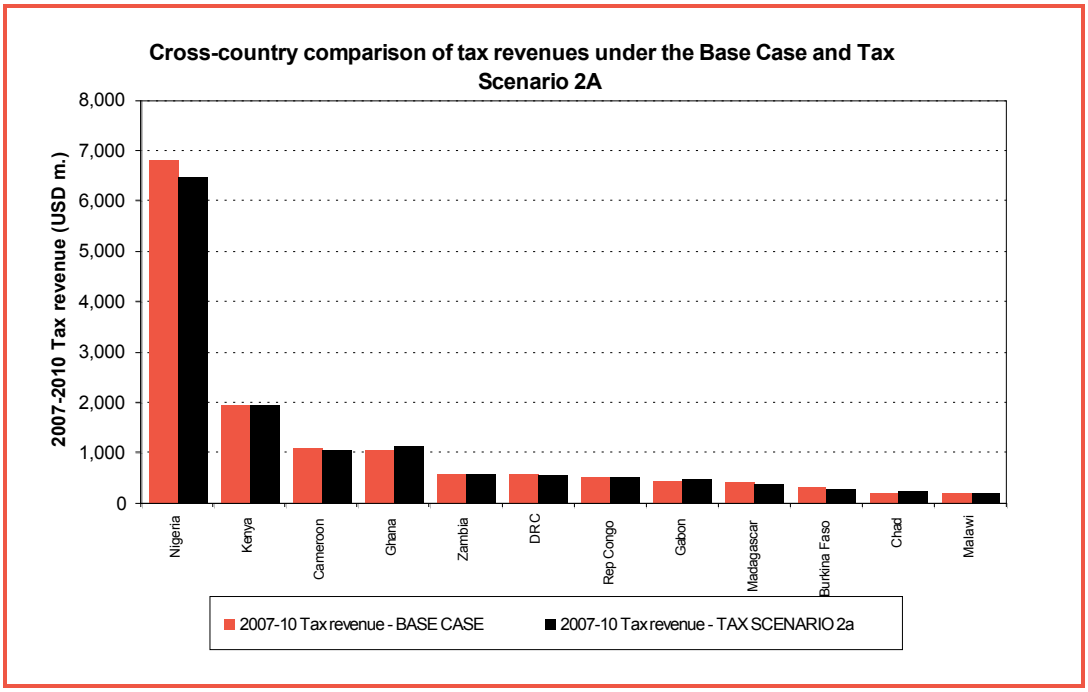

Figure 34: Cross-country comparison of tax revenues under the base case and tax scenario 2A (Removal of all import duties on handsets)

Source: Frontier analysis

4.7 EFFECT OF A REDUCTION IN TAXES ON AIRTIME

In this section we set out the results of tax scenario 3A – removal of taxes on airtime. Below we present the results of our basic model and in Annexe 5: Selected results from extended model (2007 – 2017) the results of running this scenario through the extended model for a subset of countries.

4.7.1 Results of basic model (2007-2010)

The following charts display the key cross-country outputs of our basic model over the period 2007-2010 for tax scenario 3A – removal of taxes on airtime.

Tax rates

Table 6, below, sets out the taxes charged on airtime in each of the eight countries in our sample.[30] Under tax scenario 3A we have modelled in each of the countries shown the effect of removing these taxes relative to keeping them the same.

30 These rates have either been provided directly by the major mobile operators or taken from research performed by Deloitte's for the GSMA report "Global Mobile Tax Review 2006-07"

Country	Airtime-specific taxes (excl. VAT)
Ghana	2.50%
Kenya	10.00%
Madagascar	8.00%
Nigeria	8.00%
Republic of Congo	0.90%
Tanzania	7.00%
Uganda	12.00%
Zambia	10.00%

Table 6: Tax scenario 3A - Removal of all air time specific taxes (excl. VAT)

Effect on consumer costs

Figure 35 indicates the proportionate change in usage costs between tax scenario 3A and the base case in each country on average over the period 2007-2010. That is, it indicates how the costs that consumers face change as a result of removing the taxes set out above. As shown above, the airtime specific taxes that are currently charged in these countries are relatively low and therefore the impact on the cost of usage of removing them is a reduction of less than 10% in every country. The largest impact occurs in Uganda, followed by Kenya and Zambia.

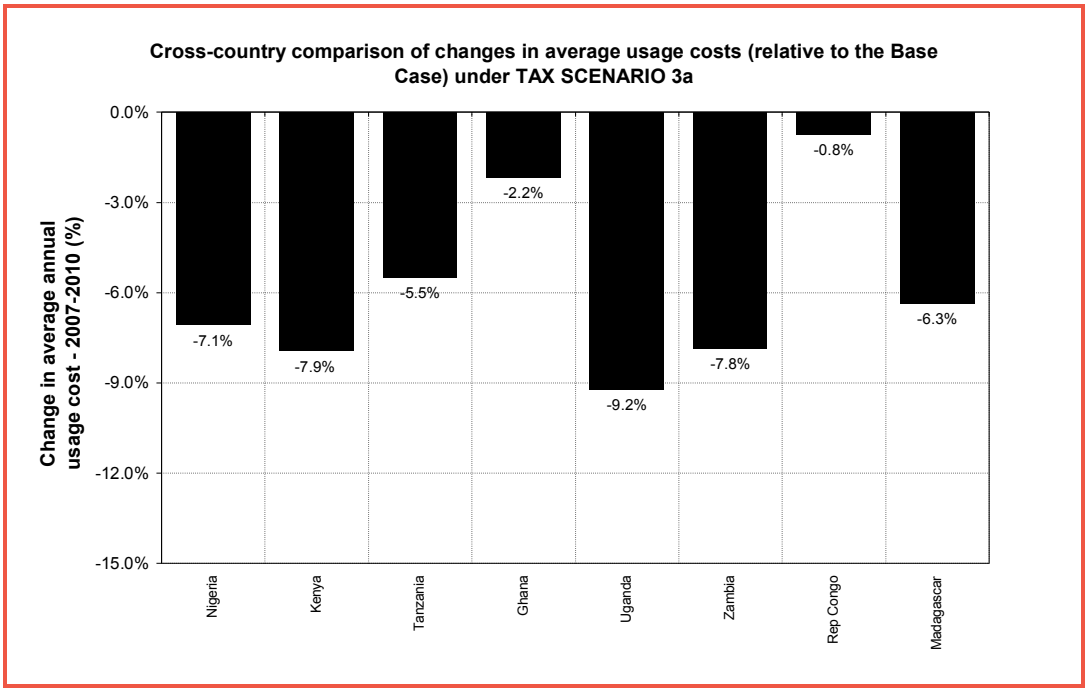

Figure 35: Cross-country comparison of change in average usage cost between tax scenario 3A and the base case

Source: Frontier analysis

Effect on penetration & total minutes of use

Removing air time taxes directly affects the average number of minutes used per consumer, through the own price elasticity of demand and also increases penetration, but less significantly as this is working through the cross-price elasticity of demand. Through the cross price elasticity, it also increases penetration, but less significantly the combined effect is therefore an increase in the total minutes of use. Total minutes of use are boosted most in Nigeria in absolute terms although in relative terms Zambia, Uganda and Kenya see total minutes of usage increase by around 14 – 15%.

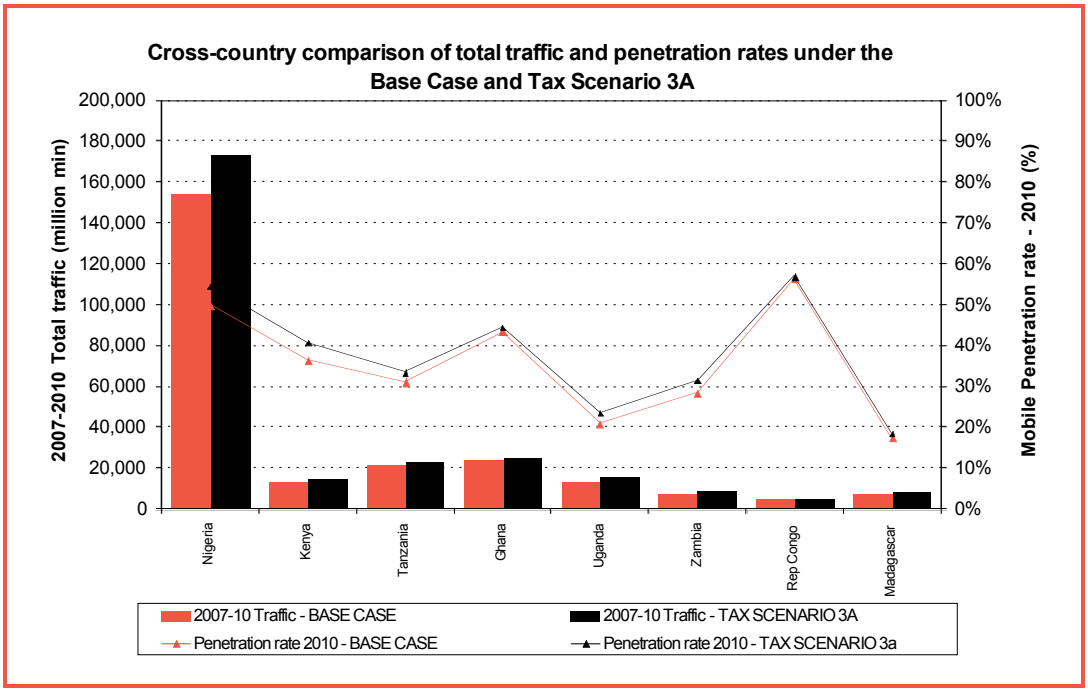

Figure 36: Cross-country comparison of penetration and total minutes of use under tax scenario 3A and the base case

Source: Frontier analysis

Effect on tax revenues

Because demand is stimulated less in this scenario it will only become fully revenue neutral over a longer period. In Annexe 4, we look more closely at the effect of removing airtime specific taxes in Kenya, where the tax on airtime is relatively high.

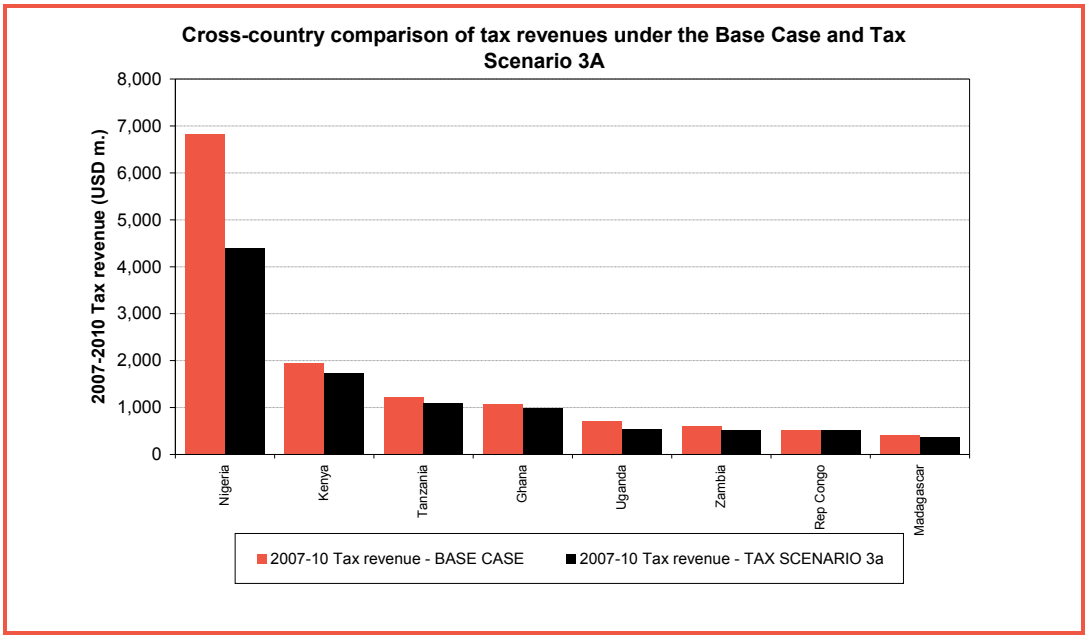

Figure 37: Cross-country comparison of tax revenues under the base case and tax scenario 3A (Removal of all airtime taxes)

Source: Frontier analysis

4.8 EFFECT OF TAX REGIMES TO IMPROVE AVAILABILITY & AFFORDABILITY OF MOBILE SERVICES

In this section we set out the results of tax scenario 4 – removal of all ownership-related taxes. Below we present the results of our basic model and in Annexe 5 we present, for a subset of countries, the results of running this scenario through the extended model. In addition, in Annexe 4 we analyse a tax scenario in Ghana, based on a recent proposal made by the government to remove ownership taxes and replace with a usage related tax.

As mentioned earlier, Scenario 4 is the scenario expected to have the most significant impact on penetration and results are presented for the period 2007-12. When comparing the results across scenarios, we present also the results for the period 2007-10.

4.8.1 Results of basic model (2007-2012)

The following charts display the key cross-country outputs of our basic model over the period 2007-2012 for tax scenario 4 – removal of all ownership-related taxes.

Tax rates

Table 7 below, in each of the twelve countries in our sample, sets out the taxes which affect the cost of mobile ownership.[31] Under tax scenario 4, we have modelled in each of the countries shown the effect of removing these taxes relative to keeping them the same in.

Country	Import duty - handsets	Other input taxes - handsets	Handset consumption taxes (excl. VAT)	Subscription-specific taxes (excl. VAT)	Unit tax on subscriptions
Burkina Faso	14.00%		1.00%		0.07
Cameroon	31.50%				
Chad	30.00%				
DRC	20.00%				
Gabon	10.00%				
Ghana	10.00%		5.50%	2.50%	
Kenya		2.25%			
Madagascar	10.00%	3.00%	3.00%		
Malawi	30.00%				
Nigeria	10.00%		7.50%		
Rep Congo	41.00%				
Zambia	5.00%				

Table 7: Tax scenario 4 - Removal of all ownership-related output taxes (excl. VAT)

Effect on consumer costs

Figure 38 indicates the proportionate change in ownership costs between tax scenario 4 and the base case in each country on average over the period 2007-2012. That is, it indicates how the costs that consumers face change as a result of removing the taxes set out above.

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31 These rates have either been provided directly by the major mobile operators or taken from research performed by Deloitte's for the GSMA report "Global Mobile Tax Review 2006-07"

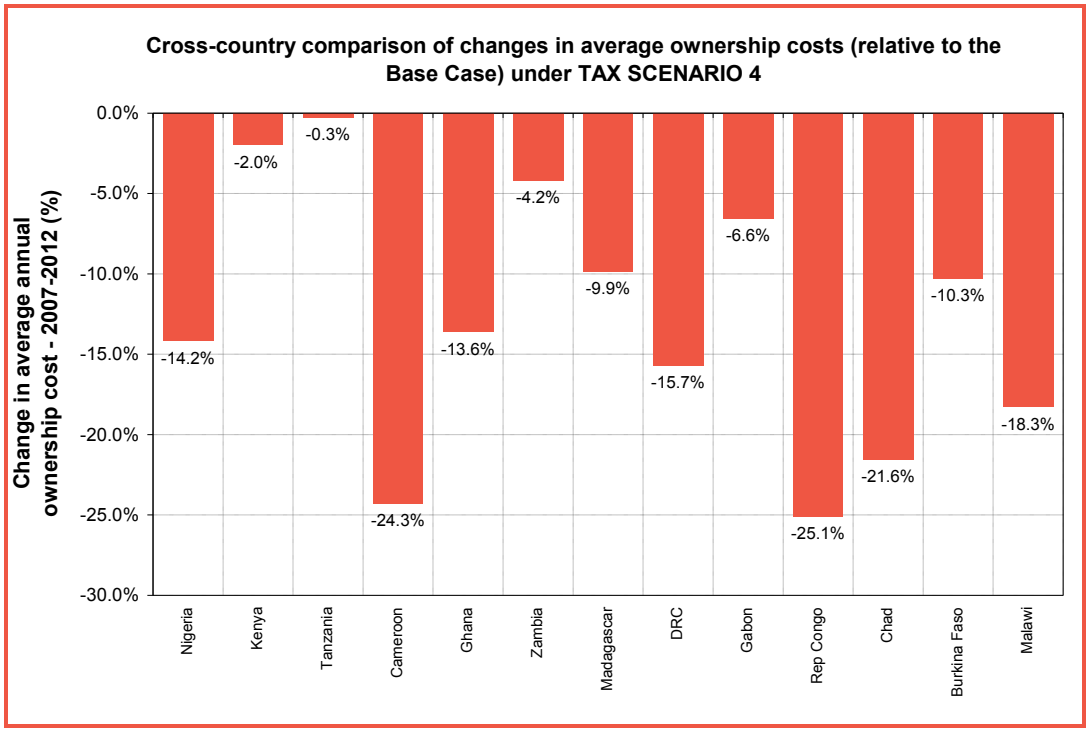


Figure 38: Cross-country comparison of change in average ownership cost between tax scenario 4 and the base case

Source: Frontier analysis

Effect on penetration & total minutes of use

Removing all ownership-specific taxes, has a similar impact to Scenario 2A where handset import duties where removed. Note however that as a result of the more material impact of the tax scenario on the cost of mobile ownership, and the longer period over which this scenario is examined, the impact on demand for mobile services is significantly more positive.

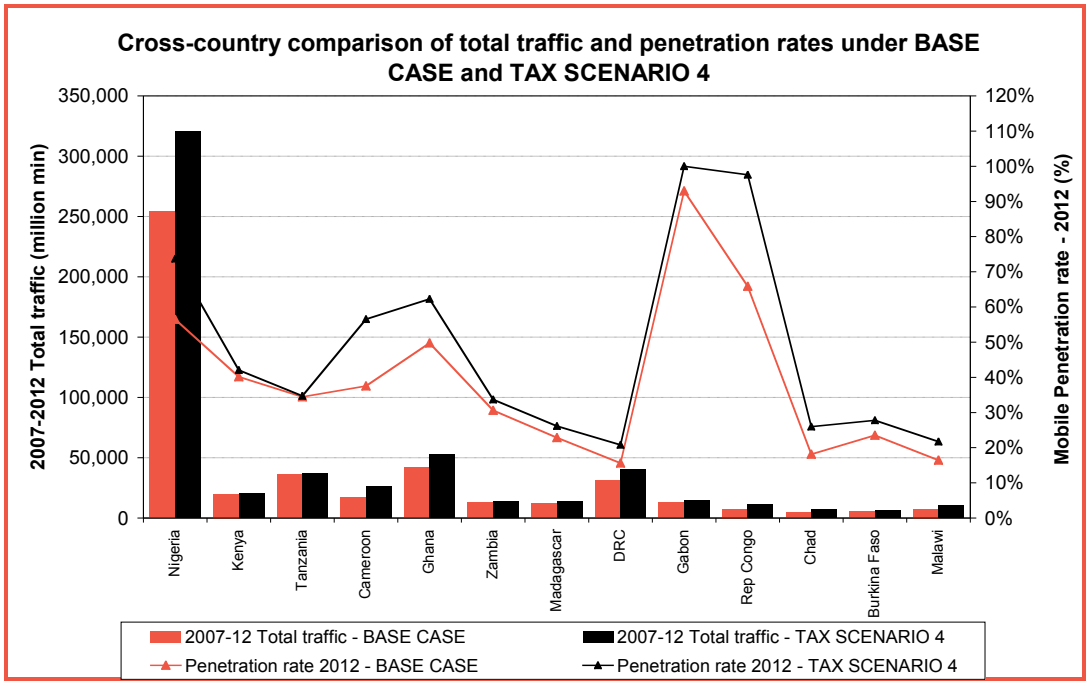


Figure 39: Cross-country comparison of penetration and total minutes of use under tax scenario 4 and the base case

Source: Frontier analysis

Effect on tax revenues

The figure below shows the resulting impact on tax revenues. As a result of the significant impact on demand for mobile services over time, we obtain that tax revenues over the period 2007-12 are higher in the tax scenario compared to the base case for 8 out of the 13 countries examined[32]. Chad and Ghana are estimated to experience the largest tax revenue increases of 17% and 14%, respectively.

32 Please not these results do not include any displacement effect – this would be expected to dampen the impact of the tax scenario on tax revenues. Please see Section 4.10 for further details.

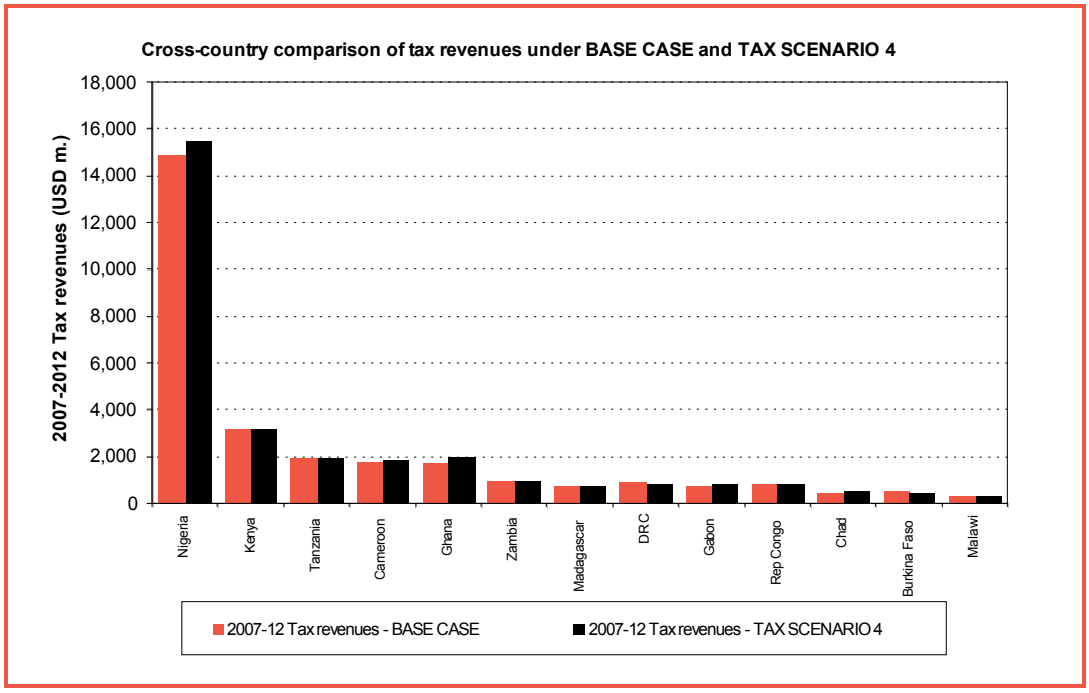


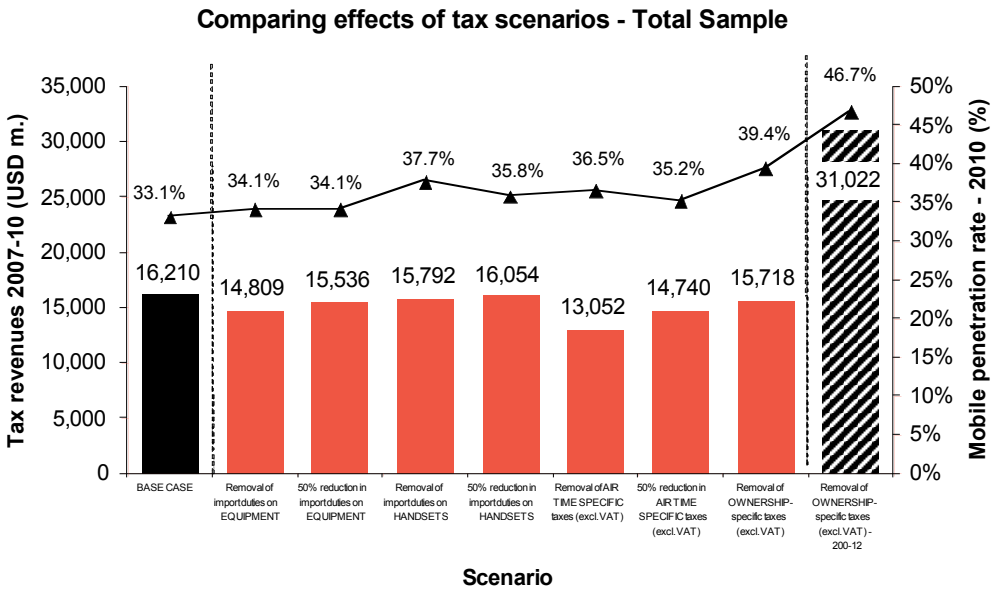
Figure 40: Cross-country comparison of tax revenues under the base case and tax scenario 4 (Removal of all ownership specific taxes, apart from VAT)

Source: Frontier analysis

4.9 CROSS-SCENARIO COMPARISON

In this section we compare across all 15 countries included in our analysis the effects of each of the eight different tax scenarios (including those where the relevant mobile taxes are only reduced by 50%). As explained in section 4.4.2, not every country could be incorporated into every scenario so therefore for some countries a particular scenario will have no effect relative to the base case. Consequently, the relative effectiveness of each scenario will to some extent be driven by the applicability of the scenario in all 15 countries.

4.9.1 Penetration and tax revenues



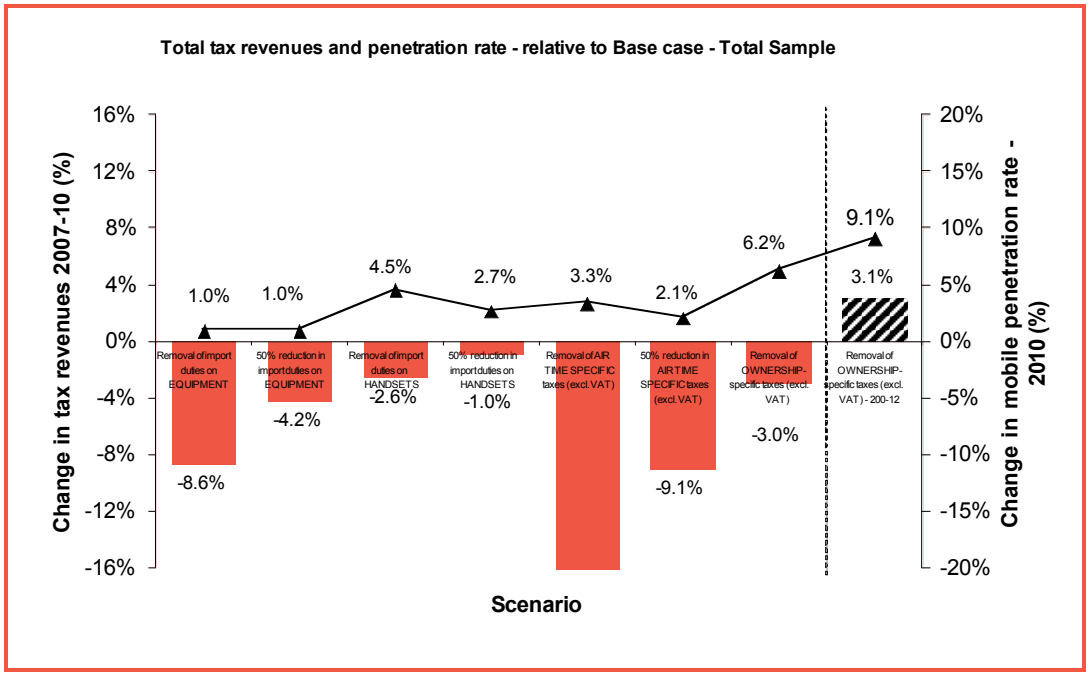


Figure 41: Cross-scenario comparison of aggregate tax revenues and weighted average penetration rates under each tax scenario relative to the base case

Source: Frontier analysis

The first chart shows how the weighted average penetration rate in 2010 and aggregate tax revenues for the period 2007 – 2010 compare under each tax scenario, including the base case[33].

The second chart shows the proportionate difference between the aggregated tax revenues and the percentage point difference in the weighted penetration rate under each scenario and the base case.

As would be expected, all of the "A" scenarios, where taxes are reduced by only 50%, have a smaller positive effect on penetration rates and smaller negative effect on tax revenues, relative to the equivalent scenarios where those taxes are completely removed.

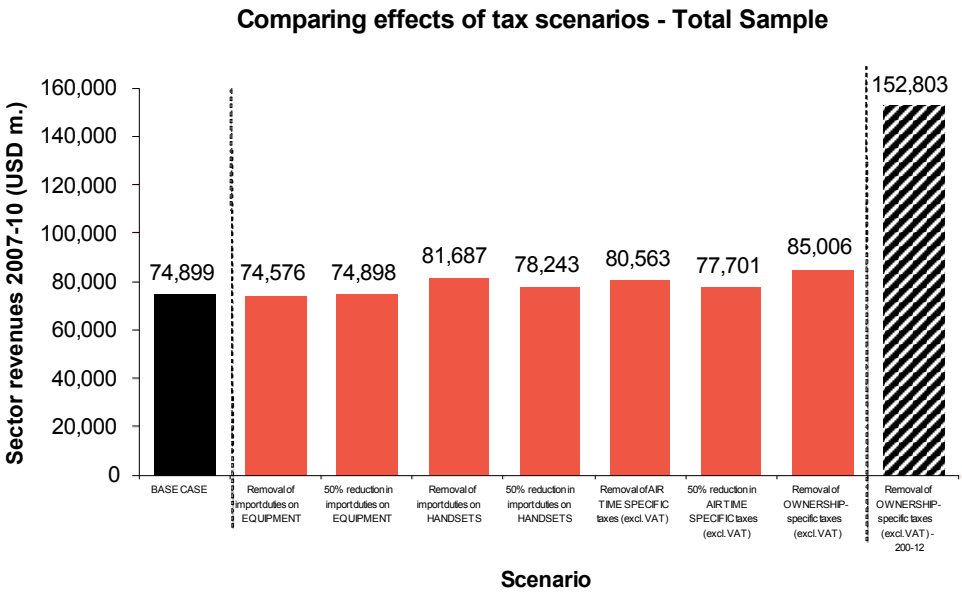
The immediate conclusion to be drawn from these charts is that tax scenarios which reduce the cost of ownership (tax scenarios 2 & 4) rather than the cost of usage (tax scenario 1[34] & 3) are more beneficial in that they boost penetration more and reduce tax revenues less (over the four year period represented in our basic model).

33 We have included the results of Scenario 4 for the extended period for completeness - these are not comparable to the other scenario results as they include 2 more years.

34 As explained in section 4.4 above, in our model, reducing equipment taxes affects all prices charged by operators. As the majority of an operators revenue is generated from airtime, reducing equipment taxes has the greatest effect on the average price of airtime and hence the cost of usage.

Furthermore, in relation to Scenario 4, as can be seen from the chart, the overall effect of the tax scenario on tax revenues changes from being negative over the period 2007-10, to being positive over the period 2007-12[35]. This illustrates the significance of time required for the 2nd round effects to feed through to tax raised, and the fact that there is significant potential for mobile penetration to increase in SSA, compared to regions where the starting level of penetration is already much higher.

4.9.2 Operator & handset vendor revenues[36]



35 As mentioned earlier, this result excludes the impact of a displacement effect – increased expenditure on mobile as a result of the tax change switching from expenditure on other goods and services where tax is raised. We have undertaken a sensitivity analysis in relation to Scenario 4, as under this tax scenario we obtain a tax positive effect over the period 2007-12. Our analysis suggests that including a displacement effect leads to a positive tax effect in an additional 1 to 2 years, depending on the magnitude of the displacement effect

36 We have included again the results of Scenario 4 for the extended period for completeness - these are not strictly comparable to the other scenario results

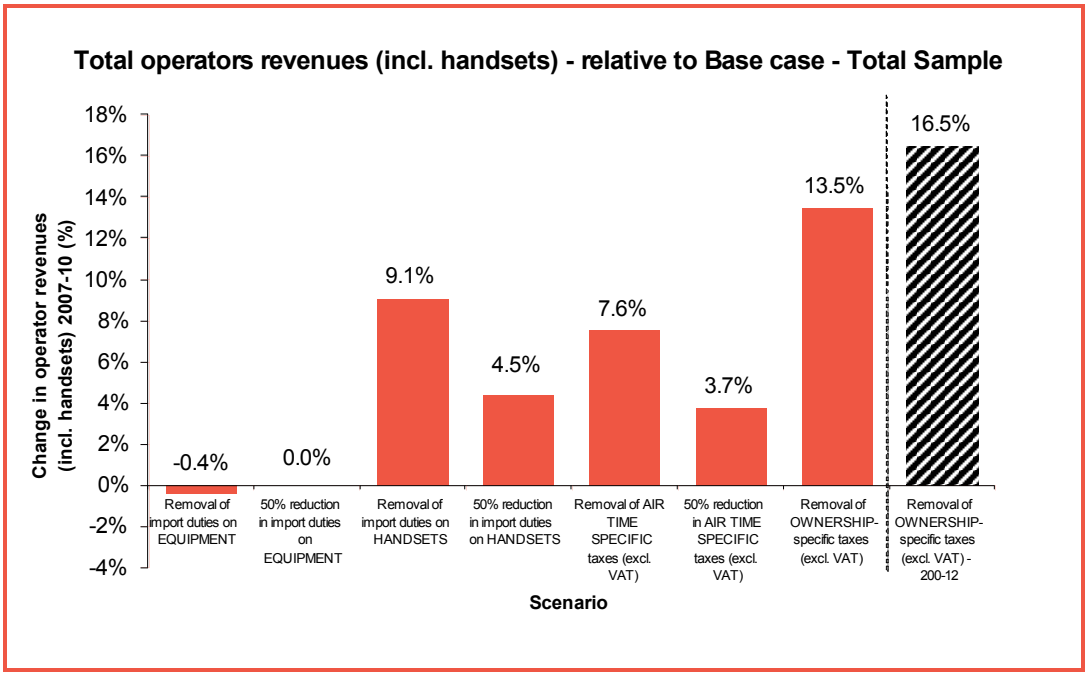


Figure 42: Cross-scenario comparison of aggregate operator & handset vendor revenues under each tax scenario relative to the base case

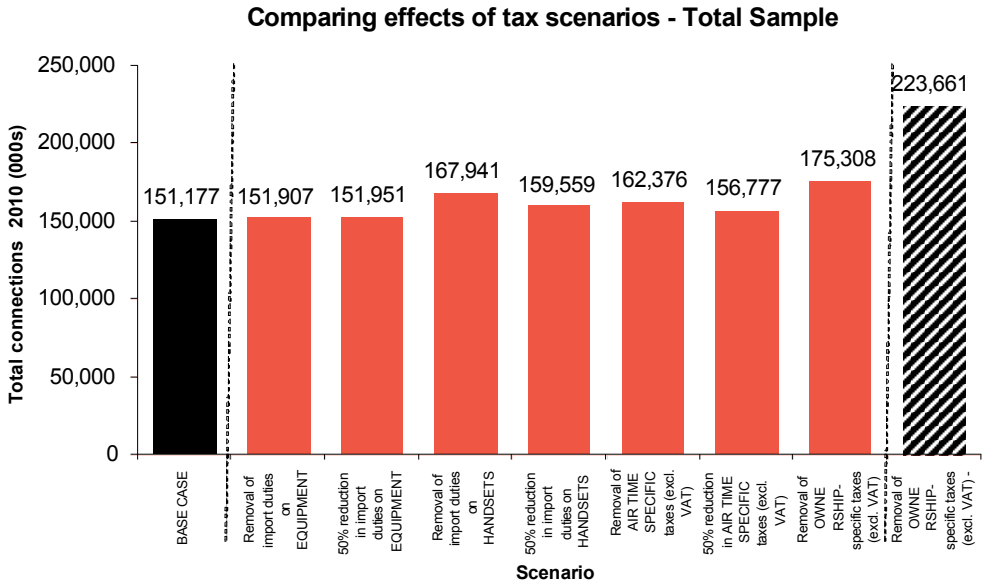
Source: Frontier analysis

The first chart shows how the aggregated revenues generated by operators & handset vendors for the period 2007 – 2010 compare under each tax scenario and the base case. The second chart shows the proportionate difference between the aggregated revenues under each scenario relative to the base case.

Scenario 1 and 1A, where taxes on equipment are reduced or removed, are the only scenarios where underlying pre-tax prices are affected. Therefore, although here the level of demand has increased, it is by a smaller proportion than consumer prices have fallen and therefore overall revenues fall slightly.

With respect to the other scenarios, reducing or removing taxes leads to demand being stimulated but no change in the *pre- tax* price which is retained by operators. Therefore operator and vendor revenue (net of taxes will increase. Again those scenarios where ownership taxes are removed (scenario 2 & 4) encourage a greater increase in penetration and therefore a greater increase in revenues.

4.9.3 Number of connections



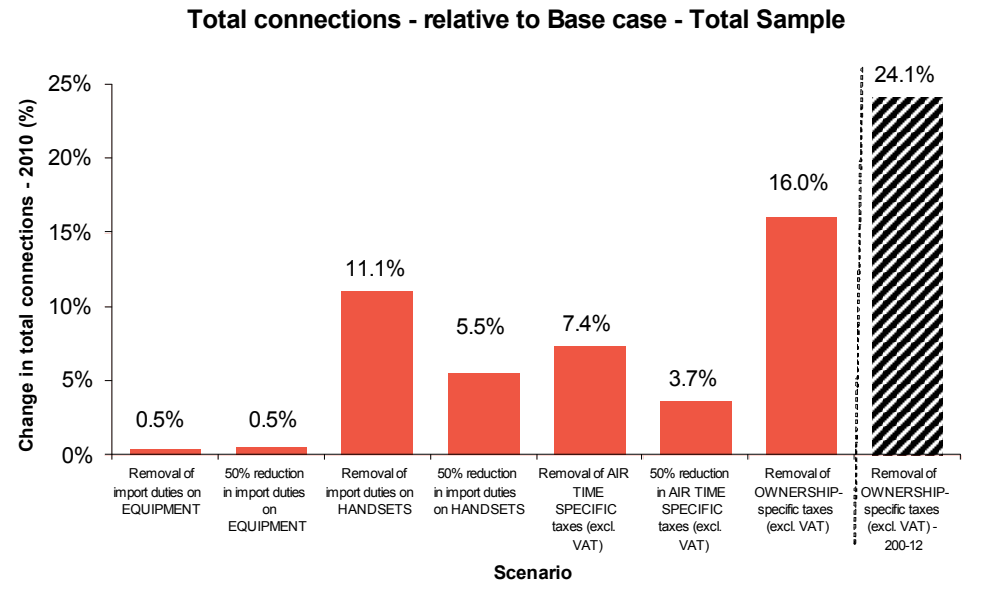


Figure 43: Cross-scenario comparison of aggregated number of connections under each tax scenario relative to the base case

Source: Frontier analysis

The first chart shows how the aggregate number of connections in 2010 and 2012 (for Scenario 4) compares under each tax scenario and the base case. The second chart shows the proportionate difference between the aggregate number of connections under each scenario, relative to the base case.

Removing any tax stimulates take up of mobile phones, either directly, through the price of ownership or indirectly through the price of usage. Therefore, in every scenario the number of connections has increased. Again, under scenarios where the cost of ownership is reduced (Scenarios 2 & 4), the effect is greater than under the scenarios where the cost of usage is reduced.

4.10 SENSITIVITY ANALYSIS

Demand elasticities

The demand elasticities used in our analysis are based on empirical evidence from developed and developing countries. We have therefore tested the sensitivity of our findings to the magnitude of these demand elasticities. We have used in particular elasticities in the range of -0.8 to -1.0, which are closer to the elasticities reported by the Deloitte study that were based on SSA country data. The overall qualitative conclusions on the Scenarios analysed are not particularly sensitive to the magnitude of these elasticity assumptions. For example, in relation to the mobile-ownership tax scenario (Tax scenario 4):

- if we use an elasticity of -0.4 for either the elasticity of ownership with respect to the price of ownership, or the elasticity of usage with respect to the price of ownership, the results of Scenario 4 are qualitatively the same; and
- if both elasticities are reduced to -0.4, then the tax neutrality is delayed by one year - i.e. 2013.

Displacement effect

The tax simulation results presented in this section do not include any displacement effect. The displacement effect aims to control for the fact that some of the additional tax revenue generated by the mobile sector might not represent additional tax revenue for the government since having been previously generated elsewhere in the economy. We have undertaken further sensitivity analysis for the mobile ownership-related tax scenario (Scenario 4) by incorporating such effect.

This analysis requires two assumptions: firstly, the assumed average indirect tax rate for the rest of the economy, and secondly, the tax revenue displacement rate (i.e. how much of the additional tax revenues generated within the mobile sector represent a substitution of tax revenues previously generated by another sector).

We have applied the country-specific VAT rate as the average other sector indirect tax rate:

- Assuming a displacement rate of 80% results in Scenario 4 become tax positive in 2013.
- Increasing the displacement rate to 90% results in tax positive results for the Scenario by 2014.
- Under a displacement rate of 50% or less, the Scenario is tax neutral by 2012.

4.11 CONCLUSIONS

Taxation of the mobile industry increases the cost of mobile ownership and usage, often quite materially and has a dampening effect on demand for mobile services. The removal of ownership taxes and particularly handset taxes is more powerful than the removal of usage taxes, in terms of its impact on demand, under the elasticity assumptions used in the study. The main reason, is that handsets are a very significant part of the cost of ownership, particularly if the expected life of a handset is only 2 or 3 years. Therefore removing such taxes will have a more significant effect on the cost of ownership than removing taxes on usage will have on the cost of usage. The absolute amount of tax revenue raised from usage (which is an ongoing cost) is larger than that raised from ownership (which is a one-off cost). Consequently, if ownership taxes are removed and participation increases, the countervailing boost to tax revenues from usage is quite significant.

There were four questions that we set out to address using our tax simulation model -

1. **What would be the effect of reducing or removing taxes on imported network equipment?**

Our analysis shows that reducing or removing taxes on imported network equipment has a less powerful effect on consumer behaviour compared to other scenarios. This result is dependent on the assumption that such taxes are recovered over the life of the asset acquired and therefore the benefit of removing such a tax would take time to feed through.

2. **What would be the effect of reducing or removing taxes on imported handsets?**

This scenario was one of the most powerful as the amortised cost of a handset makes up a large proportion of the cost of ownership. As penetration increases, this is likely to drive further increases in usage.

3. **What effect would reducing or removing taxes on airtime have?**

This scenario was more powerful than scenario 1, but relatively less powerful than scenario 2 in terms of its impact on penetration, as removing taxes on usage leads to a relatively smaller reduction in the cost of mobile services..

4. **"How could the national tax structures be altered to foster greater affordability and availability of mobile services?"**

The reduction or elimination of taxes on ownership, especially handset taxes was estimated under the elasticity assumptions used to have the most significant effect on levels of penetration and is most likely to lead to a tax revenue neutral or tax revenue positive outcome over a period of time. As such, it can be seen as being most beneficial for consumers, the industry, and the government.

Although our model does not attempt to estimate the wider economic benefits of the proposed scenarios, wider take up and use of mobile phones can be expected to have positive impacts for the whole economy. The main routes by which the wider benefits feed through are by expanding what is often the only form of

communication infrastructure in these countries and consequently increasing productivity throughout the economy (see section 3.5 for more details). For example, work by Waverman, Meschi and Fuss ("The impact of telecoms on economic growth in developing countries", Vodafone Policy Paper Series, No.2, March 2005) suggests that differences in the penetration rate across developing countries appears to explain some of the differences in growth rates. They propose that the spread of telecommunications reduces costs of interaction, expands market boundaries and enormously expands information flows; all of which contribute to enhancing economic growth. They also suggest that the growth benefits in developing countries could exceed those in more developed countries, because in developing countries mobile networks often represent the main communication network (due to the general lack of well-established fixed line network). Finally, they emphasise the importance of broad rollout of mobile networks due to the "network effects" of mobile phone use. That is, if more people own mobile phones there are additional benefits to all those who currently own mobile phones.

Expected impact of changes in current tax regimes

5 Tax and mobile industry performance indicators

In this section we consider the effect that the prevailing tax regimes in our sample of SSA countries have had on the development of the mobile industry in those countries. In particular, we address the following questions:

1. Are lower taxes associated with greater affordability of mobile services?
2. Are lower taxes associated with greater growth of the mobile sector?

5.1 DATA

The cross-country data sets we have compiled are constrained by the fact that, as explained previously, data collected for our analyses is not complete for all 30 countries in our original sample. Below we list the countries for which we had sufficient data.

- Burkina Faso;
- Cameroon;
- Chad;
- Republic of Congo;
- DRC;
- Gabon;
- Ghana;
- Kenya;
- Madagascar;
- Malawi;
- Nigeria;
- South Africa;
- Tanzania;
- Uganda; and
- Zambia

Below we set out the data sources used to obtain the data required.

Average cost of services per mobile user – was calculated through the tax simulation model (base case value for 2006) – see section 4.2.1 and Annexe 2: Tax simulation modelling for more details.

Average tax incurred per mobile user – was calculated through the tax simulation model (base case value for 2006) – see section 4.2.1 and Annexe 2: Tax simulation modelling for more details. In addition, it is important to emphasise that our tax simulation model generates estimates of the amount of

tax paid by operators and handset vendors. Although we had some limited data from some operators about the amount of tax they had actually paid in 2006, this was not provided for enough countries to generate a large enough sample. Instead we used our own estimates as they should be more consistent and we can derive them for the 15 countries for which we were able to construct a tax simulation model.

GDPpc – was obtained from the IMF Economic Outlook database.

Average MOU – was based on data provided by the operators in their responses to our data requests. Either they provided the average minutes of use per user per annum, or the total minutes of use per annum which we then converted to a per user estimate, using the number of connections (from Wireless Intelligence).

PPP conversion factor – was imputed by comparing GDP quoted in US$ and assuming current prices and GDP based on purchasing power parity, quoted in international dollars. Both series were obtained from the IMF Economic Outlook database.

Penetration rate – was taken from Wireless Intelligence.

5.2 RELATIONSHIP BETWEEN TAXES AND AFFORDABILITY OF MOBILE SERVICES

The chart below shows a scatter plot of the average tax incurred by operators & handset vendors (i.e. consumer taxes, net VAT, import duties & employment taxes) per mobile user against average cost of services for a mobile user for the 15 countries for which we were able to obtain sufficient data. This chart shows that there appears to be a positive relationship between these variables, although Ghana looks to be an outlier relative to the sample.

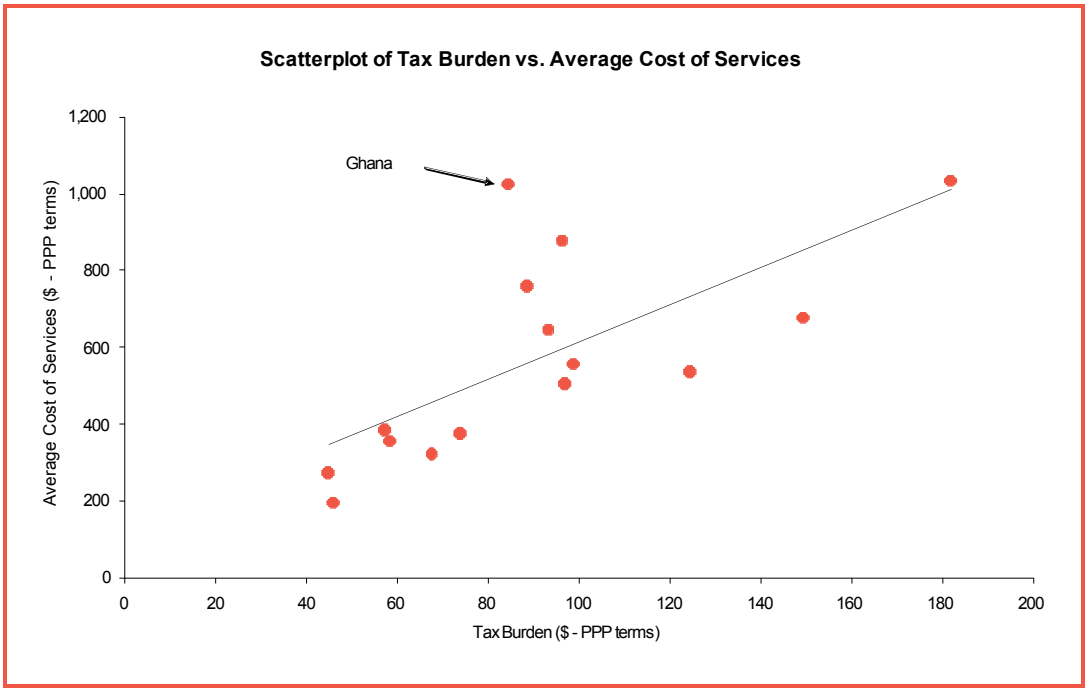


Figure 44: Scatter plot of average tax incurred per user against average cost of services

Source: Frontier analysis

5.3 TAXES AND GROWTH OF MOBILE SECTOR

The chart below shows a scatter plot of penetration against average cost of services. There appears to be a negative relationship between these variables, i.e. in those countries where the average cost of mobile services is lower, penetration is higher, although South Africa and Gabon are outliers relative to the sample.

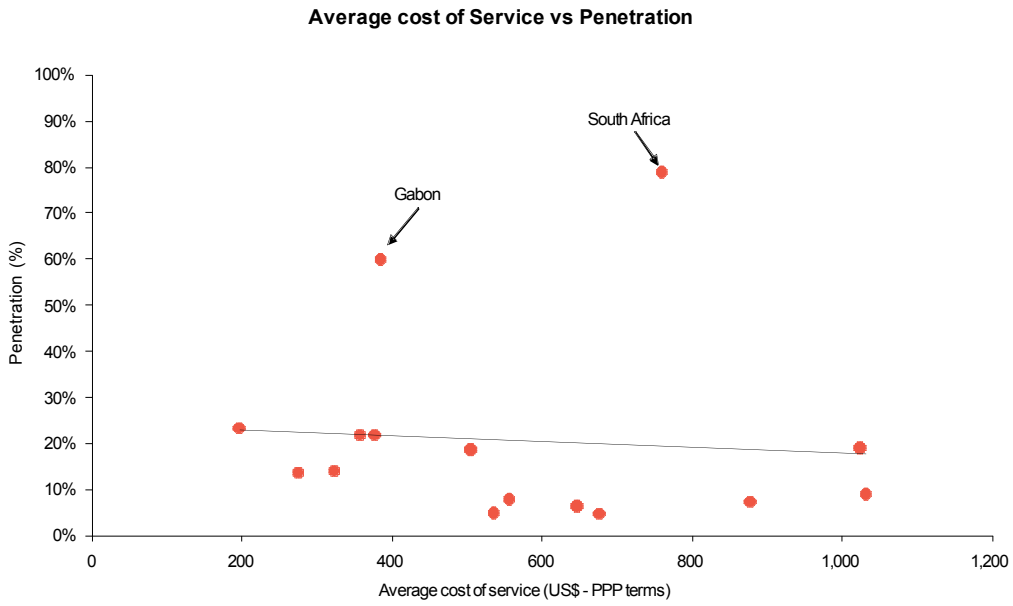


Figure 45: Scatter plot of penetration against average cost of services

Source: Frontier analysis

The level of penetration is also a function of the level of GDP per capita (measured in PPP terms). That is, in more affluent countries, a greater share of the population are likely to be mobile phone users. This is evident from the chart shown below and therefore supports the need to control for the effect of GDP per capita on the mobile penetration rate.

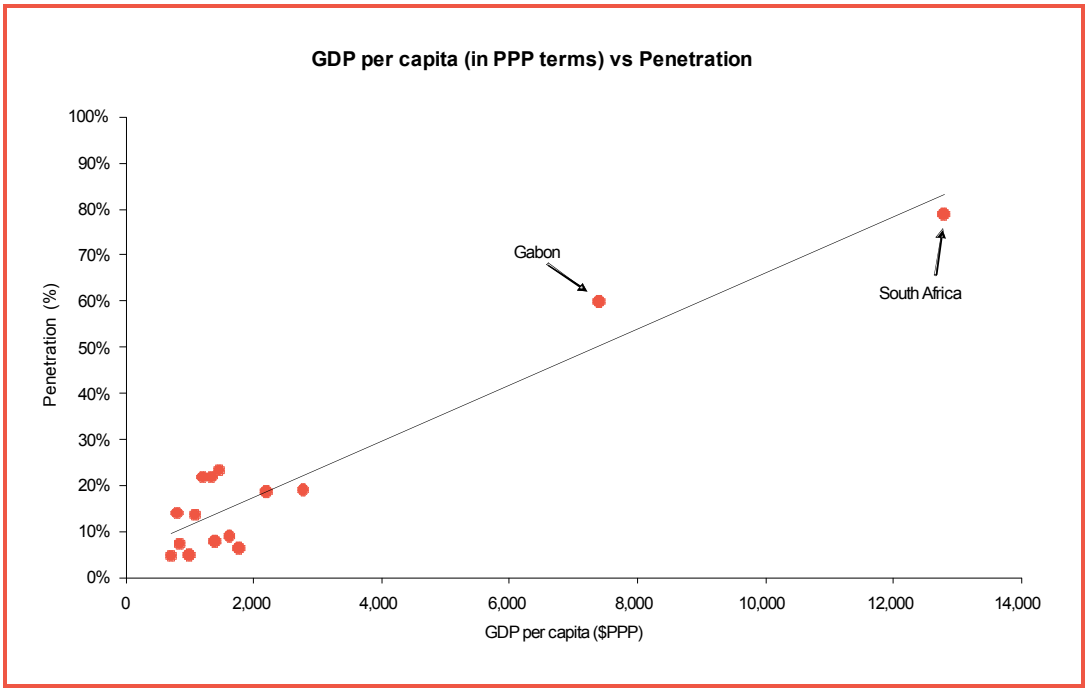


Figure 46: Scatter plot of penetration against GDPp.c. (PPP terms)

Source: Frontier analysis

To conclude, the available data from the sample of countries that have been included in our analysis, suggests that in those countries within this region where mobile operators incur lower overall levels of tax relative to the number of mobile users, mobile services are likely to be more affordable and penetration is likely to be higher, relative to those countries where mobile operators incur higher overall levels of tax.

Annexe 1: Sample sizes

The table below indicates which countries were included in the sample used for each part of our analysis.

Overview of sample size for each work stream

	Countries in Sub Saharan Africa	Entire study	Main work streams								
				Graphical analysis						Regression analysis	
			Tax simulation model	Total revenue chart	Investment analysis	Total tax payment chart	Taxes as share of total revenue chart	Direct employment chart	Total wage chart	Regression (1)	Regression (2)
1	Angola				X						
2	Benin	X			X			X			
3	Botswana	X			X			X			
4	Burkina Faso	X	X	X	X	X	X	X	X	X	X
5	Burundi				X						
6	Cameroon	X	X	X	X	X	X	X		X	
7	Cape Verde				X						
8	Central African Republic				X						
9	Chad	X	X	X	X	X	X		X	X	X
10	Comoros Islands				X						
11	Rep Congo	X	X	X	X		X	X	X	X	
12	Côte d'Ivoire	X		X	X	X		X	X	X	X
13	DRC	X	X	X	X	X	X	X	X	X	X
14	Djibouti				X						
15	Equatorial Guinea				X						
16	Eritrea				X						
17	Ethiopia				X						
18	Gabon	X	X	X	X	X	X		X	X	X
19	Gambia				X						
20	Ghana	X	X	X	X	X	X	X	X	X	X
21	Guinea	X			X						
22	Guinea-Bissau	X			X	X		X	X	X	
23	Kenya	X	X	X	X	X	X	X	X	X	X
24	Lesotho	X		X	X	X		X	X		
25	Liberia	X			X						
26	Madagascar	X	X	X	X	X	X	X		X	X
27	Malawi	X	X	X	X	X	X		X	X	
28	Mali	X		X	X	X	X			X	X
29	Mauritania				X						
30	Mauritius				X						
31	Mayotte				X						
32	Mozambique	X		X	X			X		X	X
33	Namibia				X						
34	Niger	X			X	X	X		X	X	
35	Nigeria	X	X	X	X	X	X	X	X	X	X
36	Rwanda	X		X	X	X	X		X	X	X
37	Réunion				X						
38	Sao Tomé & Principe				X						
39	Senegal	X		X	X	X	X	X		X	X
40	Seychelles				X						
41	Sierra Leone	X			X						
42	Somalia				X						
43	South Africa	X		X	X	X	X	X	X	X	
44	Sudan	X			X			X			
45	Swaziland	X		X	X	X	X	X	X		
46	Tanzania	X	X	X	X	X	X	X	X	X	X
47	Togo				X						
48	Uganda	X	X	X	X	X	X	X	X	X	X
49	Zambia	X	X		X	X	X		X	X	X
50	Zimbabwe			X	X						

Sample size	**30**	**14**	**22**	**50**	**22**	**20**	**20**	**19**	**22**	**16**
Share of total connections (2006)	**100%**	**54%**	**92%**	**106%**	**91%**	**89%**	**94%**	**85%**	**93%**	**59%**
Share of total population (2006)	**10%**	**67%**	**86%**	**123%**	**85%**	**82%**	**86%**	**75%**	**88%**	**73%**

Annexe 2: Tax simulation modelling

In this Annexe we explain certain facets of the model in more detail. This annexe should be read in conjunction with Section 5 of this report.

MODELLING APPROACH

Methodology

The model includes all taxes paid by mobile operators (except withholding taxes, secondary tax on companies and employment taxes) and only some of the taxes paid by handset vendors (input taxes on imported handsets & the output taxes on handsets sold)

Details of calculations

Step 1 – For each country the number of connections / penetration rate (as provided by Wireless Intelligence), the level of usage and total operator revenues are all taken directly from the data set for that country . Tax payments are calculated on a bottom-up basis. This is to ensure that they are comparable with the tax under the proposed tax scenario. Total tax payments are estimated as follows:

- For each country, total tax payments are made up of estimates of the following tax payments by the mobile operators and handset vendors in that country:
  - Input taxes
    - Import duties on handsets and equipment
    - Import VAT on handsets and equipment
  - Output taxes
    - VAT on handsets, airtime, subscriptions & connection fees
    - Mobile specific taxes (proportional or unit) on handsets, airtime, subscriptions & connection fees
  - Company taxes
    - Corporate tax on profits

  Using the appropriate tax rates, and the appropriate tax bases we have estimated the amount of these taxes paid by operators and handset vendors in each country. Figure 47 below indicates what the tax base is associated with each tax and where relevant, how we have calculated it. See "Calculation of prices / values and volumes" below for a detailed explanation of how each price / value and volume figure required is itself calculated.

Net VAT payments

Net VAT payments are calculated as described below:

NET VAT = IMPORT VAT + OUTPUT VAT – RECLAIMED INPUT VAT

where:

IMPORT VAT is VAT paid on imported equipment and handsets by operators and handset vendors respectively.

OUTPUT VAT is VAT paid by consumers when purchasing handsets, connections, subscription and airtime

RECLAIMED INPUT VAT is Import VAT on equipment & handsets and input VAT on other inputs reclaimed by mobile operators

Tax	Tax base	Tax base definition
Input taxes		
Import duty - Radio equipment	Total investment - Radio equipment	
Import duty - Transmission equipment	Total investment -Transmission equipment	
Import duty - Switching & core network equipment	Total investment - Switching & core network equipment	
Import duty - Software	Total investment - Software	
Import VAT - network equipment Other input tax - network equipment	Total network related investment	
Import duty - handsets Import VAT - handsets Other input tax - handsets	Wholesale value of imported handsets	Average wholesale price x Total no. handsets sold on legitimate market
Output taxes		
VAT - Handsets Other consumption taxes - handsets	Total revenue from sale of legitimate handsets	Average wholesale price x Total no. handsets sold on legitimate market
Unit tax - handsets	Total number of handsets sold on legitimate market	
VAT - connection Other consumption taxes - connection	Total revenue from connection fees	Average connection fee x Total no. new connections
Unit tax - connection	Total number of new connections	
VAT - subscriptions Other consumption taxes - subscriptions	Total revenue from post-pay subscriptions	Average subscription fee x Total no. of post-pay subscribers
Unit tax - subscription	Total number of post-pay subscriptions	
VAT - mobile usage Other consumption taxes - mobile usage	Total revenue from usage	Average cost of usage per user x Total no. connections
Unit tax - usage	Total MOU	
Company taxes Corporate tax	Profit before tax	

Figure 47: Tax base associated with each tax

Source: Frontier

The base case tax rates used are shown below. These were sourced either directly from the mobile operators or from research performed by Deloitte for the GSMA report "Global mobile tax review 2006-07".

Annexe 2: Tax simulation modelling

Country	Input Taxes							Employment		Corporate Tax
	Equipment					Handsets				
	Import Duties*									
	Radio equipment	Transmission equipment	Switching & core network equipment	Software	Import VAT	Import Duties	Import VAT	Income Tax	National Insurance	
Burkina Faso	7.5%	8.0%	7.5%	0.0%	18.0%	14.0%	18.0%	30.0%	30.0%	35.0%
Cameroon	22.5%	22.5%	22.5%	22.5%		31.5%	0.0%			38.5%
Chad	26.8%	14.2%	14.2%	39.6%		30.0%	0.0%			45.0%
Rep Congo	20.0%	20.0%	20.0%	20.0%	21.6%	41.0%	21.6%	30.0%		38.0%
DRC	0.0%	0.0%	0.0%	0.0%		20.0%		40.0%		40.0%
Gabon	15.0%	15.0%	20.0%	0.0%	18.0%	10.0%	18.0%	22.1%	20.1%	25.0%
Ghana	10.0%	10.0%	10.0%	10.0%		10.0%	15.0%			25.0%
Guinea	2.5%	2.5%	2.5%	2.5%		12.5%				35.0%
Kenya	10.0%	10.0%	10.0%	25.0%	16.0%		16%***			30.0%
Madagascar	10.0%	10.0%	10.0%	20.0%	18.0%	10.0%	18.0%			30.0%
Malawi	45.0%	5.0%	10.0%	0.0%	18.0%	30.0%	18.0%	29.0%		30.0%
Nigeria	12.0%	12.0%	12.0%	0.0%	5.0%	10.0%	5.0%	25.0%		30.0%
South Africa	0.0%	0.0%	0.0%	0.0%	14.0%	8.1%	14.0%			29.0%
Tanzania	20.0%	20.0%	20.0%	20.0%	20.0%		20.0%	15.0%		30.0%
Uganda	10.0%	0.0%	10.0%	0.0%	18.0%		18.0%		30.0%	30.0%
Zambia	15.0%	15.0%	10.0%	0.0%	17.5%	5.0%	17.5%	30.0%	5.0%	35.0%

Country	Output Taxes						
	Handsets		Airtime		Subscriptions & Connections		
	VAT	Other*	VAT	Other*	VAT	Other*	Fixed
Burkina Faso	18.0%	1.0%	18.0%		18.0%		0.07 CFC****
Cameroon	19.3%		19.3%		19.3%		
Chad	18.0%		18.0%		18.0%		
Rep Congo	21.6%		18.0%	0.9%	0.0%		
DRC	13.0%		18.0%		0.0%		
Gabon	18.0%		18.0%		18.0%		
Ghana	12.5%	5.5%	12.5%	2.5%	12.5%	2.5%	
Guinea	18.0%		18.0%		18.0%		
Kenya	16.0%		16.0%	10.0%	0.0%		
Madagascar	18.0%	3.0%	18.0%	8.0%	18.0%	0.0%	
Malawi	17.5%		17.5%		17.5%		
Nigeria	5.0%	7.5%	5.0%	8.0%	5.0%	0.0%	
South Africa	14.0%		14.0%		14.0%		
Tanzania	20.0%		20.0%	7.0%	20.0%		
Uganda	18.0%		18.0%	12.0%	18.0%		
Zambia	17.5%		17.5%	10.0%	17.5%		

* "Other" refers to mobile-specific taxes
** excluding 3.65% of other taxes on imported equipment
*** excluding 2.25% IDF fee on handsets
**** levied on subscription only

Figure 48: Tax rates (base case)

Source: Operator data; Data collected by Deloitte

Step 2 – In order to calculate the cost of ownership under the base case we require the following inputs:

- Average cost of a handset spread over its expected life, for which we need:
  - average price of a handset;

Annexe 2: Tax simulation modelling

- average life of a handset; and
- handset input and output tax rates (see Figure 48).

- Average cost of connection spread over the average time with one operator, for which we require:
  - average connection fee;
  - churn rate; and
  - connection output tax rates.
- Average annual cost of subscriptions to the average user (i.e. weighted by the proportion of users which are post-pay), for which we need:
  - average annual cost of post-pay subscription;
  - proportion of connections which are post-pay (taken from Wireless Intelligence); and
  - subscription output tax rates (see Figure 48).
- Average annual cost of usage per user:
  - average annual cost of usage per user; and
  - consumer tax rates on usage (see Figure 48).

These are then recalculated under the scenario using the consumer tax rates proposed under that scenario. Note that if equipment taxes are changed, this will alter the pre-tax consumer prices (as explained in section 4.4).

Step 3 – Using estimated elasticities of demand we determine the effect on demand for connections and average usage as outlined below[37]:

$$\%\text{ chg D connections} = \%\text{ chg C connections} \times \text{PED connections} + \%\text{ chg in C usage} \times \text{XED connections}$$

$$\%\text{ chg D average usage} = \%\text{ chg C usage} \times \text{PED usage} + \%\text{ chg in C connections} \times \text{XED usage}$$

Note that we assume that all connections (including new connections) use the calculated average number of minutes of use per user.

Step 4 - All of the various industry indicators are recalculated in a bottom-up fashion, incorporating the new tax rates, new number of connections and minutes of use resulting from step 3 above.

37 Where: D = demand; C = average consumer cost; PED = own price elasticity of demand; XED = cross price elasticity of demand.

Annexe 2: Tax simulation modelling

Calculation of prices / values and volumes

Prices / Values

Average prices / values have been calculated as explained below:

- Average handset wholesale price – estimated average handset retail price in 2007 adjusted downwards by estimated retail margin and reduced by 2% per annum.
- Average handset retail price – used estimates of the average price paid (on the legitimate market)
- Average airtime cost per user, average subscription price per user; average connection fee per user – calculated by splitting revenue into that part which is generated from usage, subscriptions and connection fees and then calculating the average revenue generated from each using the number of connections; the number of post-pay connections; and the number of new connections (both joining market and switching between providers) respectively.
- Average investment in network equipment – split out capital expenditure into that which is network related, comprising investment in radio equipment, transmission equipment, switching & core network equipment and software.
- Profit before tax – as provided by operators or estimated as average PBT margin applied to total revenue

Volumes

Average volumes have been calculated as explained below:

- No. of handsets – we have assumed that all new users require a handset and taken an assumption about the average life of a handset to determine how many existing users will also require a new handset. For the purposes of determining tax revenues, this number has then been reduced based on an assumption about the proportion of the market which is grey (as no tax will be paid on handsets which are acquired on the grey market).
- No. of connections (for airtime) – as provided by Wireless Intelligence
- No. of post-pay connections (for subscriptions) – as provided by Wireless Intelligence
- No. of new connections (for connection fees) – increase in the number of connections and the number of churners, based on the current churn rate.
- Average MOU – either provided directly by operators or calculated as total minutes of use per annum divided by the number of connections.

MODELLING ASSUMPTIONS

Elasticities

The following elasticities were applied:

Annexe 2: Tax simulation modelling

ELASTICITIES	Own price	Cross-price
Ownership	-0.54	-0.50
Usage	-0.80	-0.50

Handsets

Assumptions	
Average retail price of a handset (unless country specific information was provided)	US$ 75
Annual reduction of retail prices between 2007-10	10%
Share of import cost in total cost of handset	95%
Average handset distributors' profit margin	15%
Average life time of a handset (unless country specific information was provided)	2 years
Share of grey market handsets of total handsets (unless country specific information was provided)	40%
The price of a grey market handset is assumed to decline by the same proportion as the price of a legitimate handset. This implies that the relative price of a legitimate and a grey handset would remain unchanged and therefore we would not expect the share of handsets sold through the grey market to decline over time. Consequently, the share of grey market handsets is expected to be constant over the modelling period.	

Usage

Assumptions	
Share of incoming minutes in total traffic	25%
Average annual churn (unless country specific information was provided):	25%
New users have the same usage as established users.	-

Revenue

Assumptions	
Share of termination revenue in total service revenue	20%
The following split of total service revenue was assumed (unless country specific information was provided):	
Connection revenues	1.0%
Subscription revenues	0.1%
Pre-pay air time revenues	93.9%
Post-pay air time revenues	5.0%

Investment

Assumptions	
Share of network-related investment in total investment (unless country specific information was provided): :	65%
The following split of network related investment was assumed (unless country specific information	
Radio equipment:	35%
Transmission equipment:	27%
Switching & core network equipment:	32%
Software in total network- related investment:	6%
The following average asset life times were assumed):	
Radio equipment	10 years
Transmission equipment	6 years
Switching & core network equipment	10 years
Software	5 years

Input VAT

Assumptions	
Average additional input VAT for mobile operators (measured as a proportion of output VAT)	50%

Annexe 2: Tax simulation modelling

FORECAST DATA FOR EXTENDED MODEL

Using the data underlying the basic model to 2010 we attempted to extrapolate the necessary input data forward to 2017 or 2012 (in the case of scenario 4). The following rules were applied:

- Penetration - Plotted penetration rates from 2000 – 2012 from Wireless Intelligence to assess where each country would be on the "S-curve" by 2012. Consequently we used our judgement to consider how penetration might continue to develop to 2017.
- Population - Assumed that population would continue to grow at average historic rates (which seemed to be fairly consistent at about 2 – 3% p.a.) to 2017.
- No. connections - Induced the number of connections from our forecasts of the penetration rate and total population.
- Pre-pay share – Share of pre pay customers in total connection was assumed to remain constant at 2010 level.
- Share of grey-market handsets – The share of handsets sold in the grey market was assumed to remain constant over time.
- Investment - Assumed that investment would grow in line with the number of net additions (i.e. holding investment per net addition at historic levels).
- Average usage – Average (blended) monthly usage was assumed to continue to follow observed, historic trends.
- Total Revenues – Market revenues were forecast based on trends in average price per minute and the total minutes of use (based on average usage and the number of connections).
- Profit – Total profits before tax were estimated assuming that the PBT margin remained constant.

Annexe 2: Tax simulation modelling

Annexe 3: Calculation of the multiplier

We have estimated a multiplier for each country for which we could obtain sufficient, seemingly robust data. This multiplier has then been used to estimate in each of these countries the wider economic impact that the entire mobile value chain has on the local economy.

DERIVING THE MULTIPLIER

We started by considering a standard Keynesian multiplier which we have derived below.

The Keynesian investment multiplier

$$Y = C + I + G - T + (X\text{-}M) \quad (1)$$

$$Y = cY + I + G - tY + (X - mY) \quad (2)$$

$$Y - cY + tY + mY = I + G + X \quad (3)$$

$$Y(1 - c + t + m) = I + G + X \quad (4)$$

$$Y = I/(1 - c + t + m) + G/(1 - c + t + m) + X/(1 - c + t + m) \quad (5)$$

$$dY/dI = 1/(1 - c + t + m) \quad (6)$$

where:

Y = GDP

C = Household consumption; c = propensity to consume, relative to GDP

I = Investment

G = Government expenditure

T = Taxation; t = propensity to tax, relative to GDP

X = Exports of goods

M = Imports of goods; m = propensity to import, relative to GDP

Equation (1) explains how GDP is derived and equation (2) indicates which of these variables vary with the level of GDP and which are independent of the level of GDP. Equation (2) can be rearranged to understand how income relates to the rest of the economy – see equations (3,4,5). By differentiating this equation with respect to I we determine how the level of income would change if there was a change in investment - see equation (6). This is the standard Keynesian multiplier.

DATA

We used national accounts data from the IMF and World Bank in order to estimate proxies for the necessary marginal propensities and hence the value of the multiplier in each country. Note that we have calculated *average* propensities rather than marginal propensities and have had to assume that these were reasonable approximations. We did not calculate a multiplier for every one of the 30 countries in our sample for one of the following reasons:

- we could not obtain the data required from the IMF or the World Bank; or
- we did not have sufficient data to calculate the direct and indirect contribution of the mobile sector and therefore had nothing to apply the multiplier to.

As we were not able to obtain data in exactly the right form we had to make a number of assumptions and adjustments in order to be able to estimate the propensity to consume and import.

Calculating "c"

"c" was estimated using IMF data (where available) on the national domestic savings ratio (savings / GDP). We assumed that the proportion of disposable income saved by households reflects the proportion of GDP which is saved by the whole economy. We were then able to calculate consumption as a proportion of disposable income and then re-scale this relative to GDP.

Calculating "m"

"m" was calculated based on World Bank data (where available) on the total level of imports. However, as this figure incorporated imported goods for businesses and government as well as imported goods for households, it required adjustment. The assumption that we made was that the proportion of households' expenditure used to purchase imported goods would reflect the proportion of GDP which was spent on total imports.

Adjusting the savings ratio

Due to concerns about the robustness of some of the IMF data, we replaced the savings ratio in three countries Chad, Republic of Congo, Nigeria. In each case the reported savings ratios appeared significantly out of line with the rest of the sample, probably due to underlying data collection or measurement errors. We replaced it with a weighted average across the remaining 27 countries (which amounted to 15.2%).

Figure 49 sets out the magnitude of the GDP multipliers that have been estimated for each country and the figures which underlie these multipliers.

Country	m	c	Multiplier
Burkina Faso	26.4%	81.1%	2.21
Cameroon	19.7%	73.6%	2.17
Chad	31.1%	81.1%	2.00
Congo (Brazzaville)	36.5%	79.2%	1.75
Gabon	7.9%	33.4%	1.34
Ghana	49.5%	77.7%	1.39
Kenya	25.3%	75.8%	2.02
Madagascar	33.3%	81.4%	1.93
Niger	19.8%	81.5%	2.61
Nigeria	28.6%	79.6%	2.04
Rwanda	26.4%	83.9%	2.35
South Africa	20.0%	60.6%	1.68
Swaziland	48.0%	55.4%	1.08
Tanzania	23.0%	74.7%	2.07
Uganda	24.4%	79.3%	2.22
Zambia	15.7%	65.2%	1.98

Figure 49: GDP multiplier estimates

Source: IMF / World Bank / Frontier analysis

where:

- c = proxy for propensity of households to consume both domestic and imported products relative to GDP
- m = proxy for propensity of households to consume imported products relative to GDP

Sensitivity analysis

We recalculated the multipliers for each country based on the assumption that the savings rate was 10%. This provided us with alternative estimates of the multipliers.

Annexe 3: Calculation of the multiplier

Country	m	c	Multiplier
Burkina Faso	26.4%	79.1%	2.12
Cameroon	21.2%	79.1%	2.38
Chad	33.0%	86.0%	2.13
Congo (Brazzaville)	38.7%	84.1%	1.83
Gabon	18.8%	79.2%	2.53
Ghana	46.2%	72.4%	1.35
Kenya	25.0%	75.2%	2.00
Madagascar	32.7%	80.0%	1.90
Niger	19.5%	80.2%	2.55
Nigeria	30.4%	84.5%	2.18
Rwanda	24.4%	77.3%	2.13
South Africa	21.9%	66.3%	1.80
Swaziland	50.2%	58.0%	1.08
Tanzania	23.5%	76.2%	2.11
Uganda	23.6%	76.9%	2.14
Zambia	17.7%	73.6%	2.27

Figure 50: Alternative GDP multiplier estimates

Source: IMF / World Bank / Frontier analysis

Note that we did not use the multipliers shown here to calculate the wider economic impact of the mobile sector as presented in Figure 25 and Figure 26. However, this does indicate that the results presented are dependent on the validity of the data underlying them.

Higher multipliers would lead to a higher estimated wider economic impact.

Annexe 3: Calculation of the multiplier

Annexe 4: Tax simulation case studies

In this annex, we present more detailed results from our tax simulation model for the following three country-specific case studies:

- removal of import duties on handsets in Cameroon;
- removal of air time specific taxes in Kenya; and
- the recently proposed changes to the mobile-specific tax regime in Ghana (this involves removing both the import duty and import VAT on handsets and introducing an airtime tax).

In each case we indicate what the relevant tax rate currently is and what, based on our simulation model, the effect of removing it would be on the average costs of mobile ownership and usage. We then set out the impact of the tax scenario on:

- mobile penetration;
- average usage per subscriber;
- operator revenues (including handsets); and
- operator tax payments (including handsets).

CAMEROON – TAX SCENARIO 2

Cameroon currently levies an import duty of 31.5% on imported handsets. If this tax was removed, the average ownership cost would be on average 22.6% lower over the whole period and the average usage cost would be unchanged.

Key results

As shown in Figure 51, removing handset import duties leads to penetration increasing at an increasing rate. By 2010, penetration is expected to be approx 11 percentage points higher than it would have been under the base case.

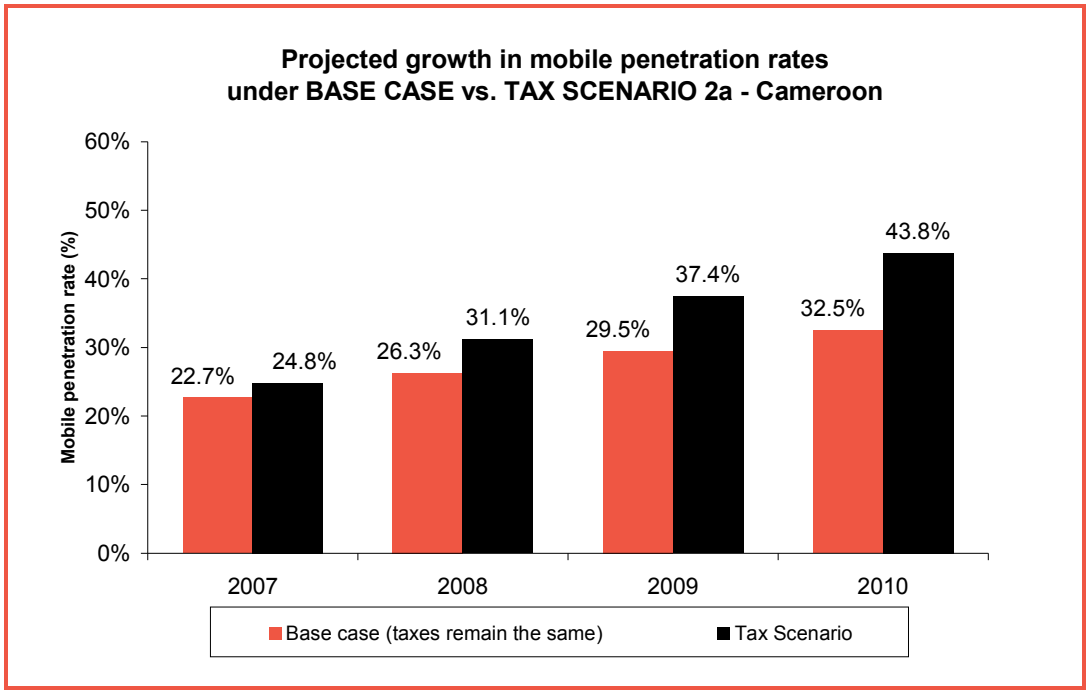


Figure 51: Mobile penetration rates in Cameroon under the base case and tax scenario 2A (Removal of import duties on handsets)

Source: Frontier analysis

In addition to the direct impact on participation, the reduction in average ownership costs further triggers an (indirect) response in the demand for minutes of use per user. Figure 52 shows the projected growth in average annual minutes of use per user under the base case and the tax scenario. By 2010, average annual usage could be 11% higher than if this tax was left in place.

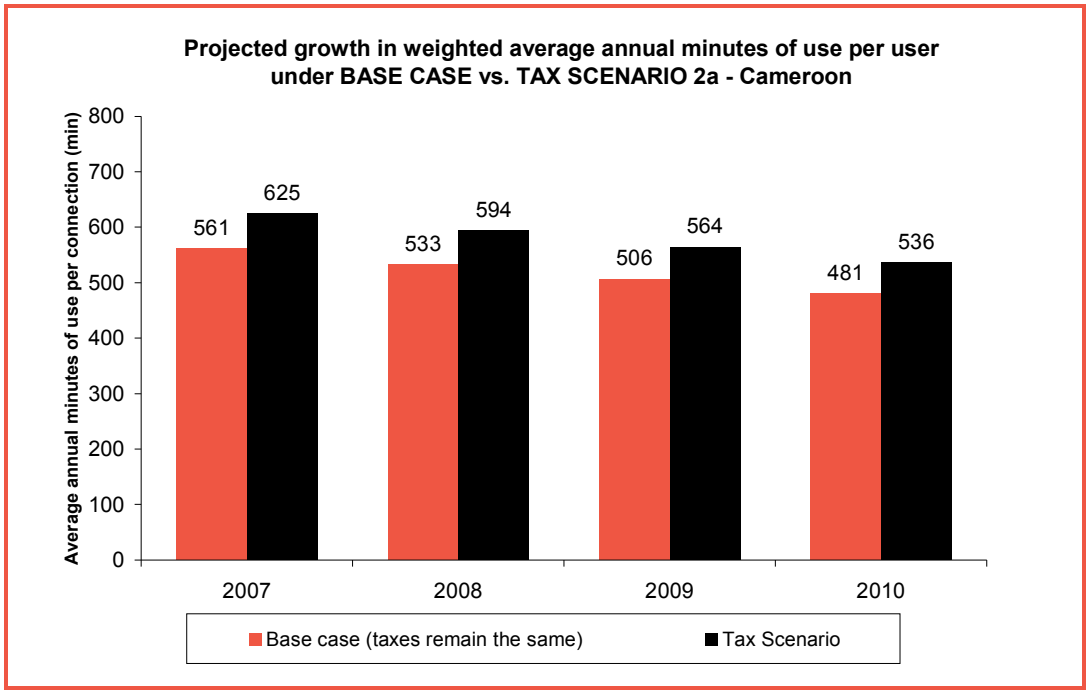


Figure 52: Weighted average annual minutes of use per user in Cameroon under the base case and tax scenario 2A (Removal of import duties on handsets)

Source: Frontier analysis

Given the expected increase in participation and average usage per user in the absence of import duties on handsets, total operator revenues are projected to exceed those under the base case. As shown in Figure 53, total operator revenues in 2010 could be 32% higher under this tax scenario, compared to the base case.

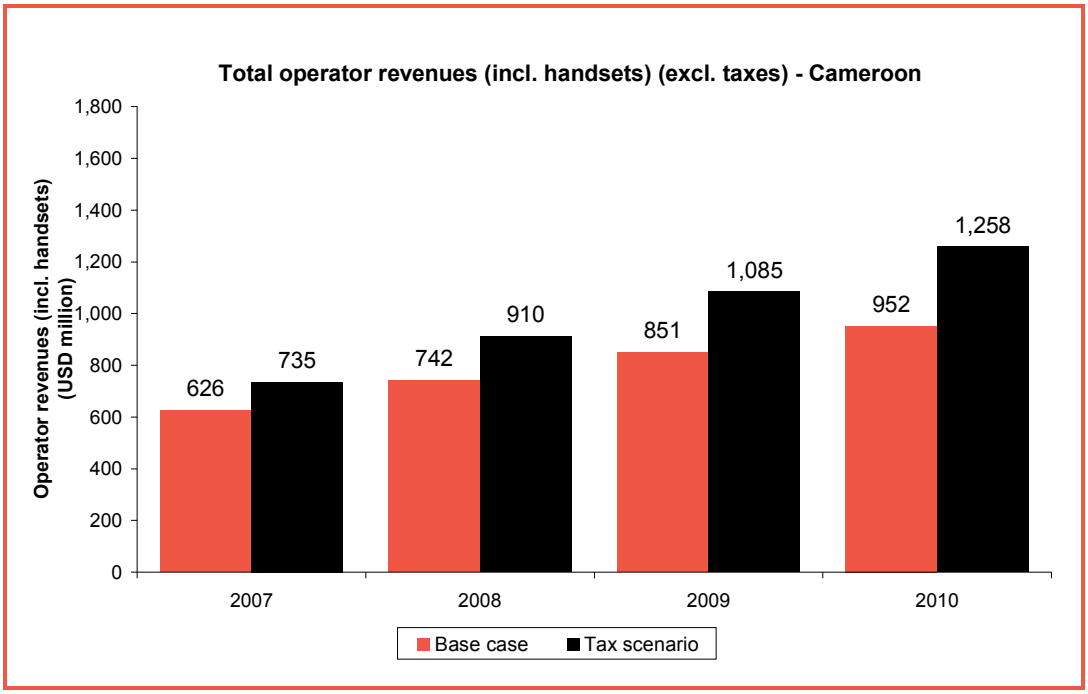


Figure 53: Total operator and handset vendor revenues in Cameroon under the base case and tax scenario 2A (Removal of import duties on handsets)

Source: Frontier analysis

Figure 54 presents the projected impact on industry tax payments under the base case and this tax scenario. Removing import duties on handsets may result in higher tax revenues within four years. The increase in tax revenues under the scenario are driven by the increases in penetration and average usage.

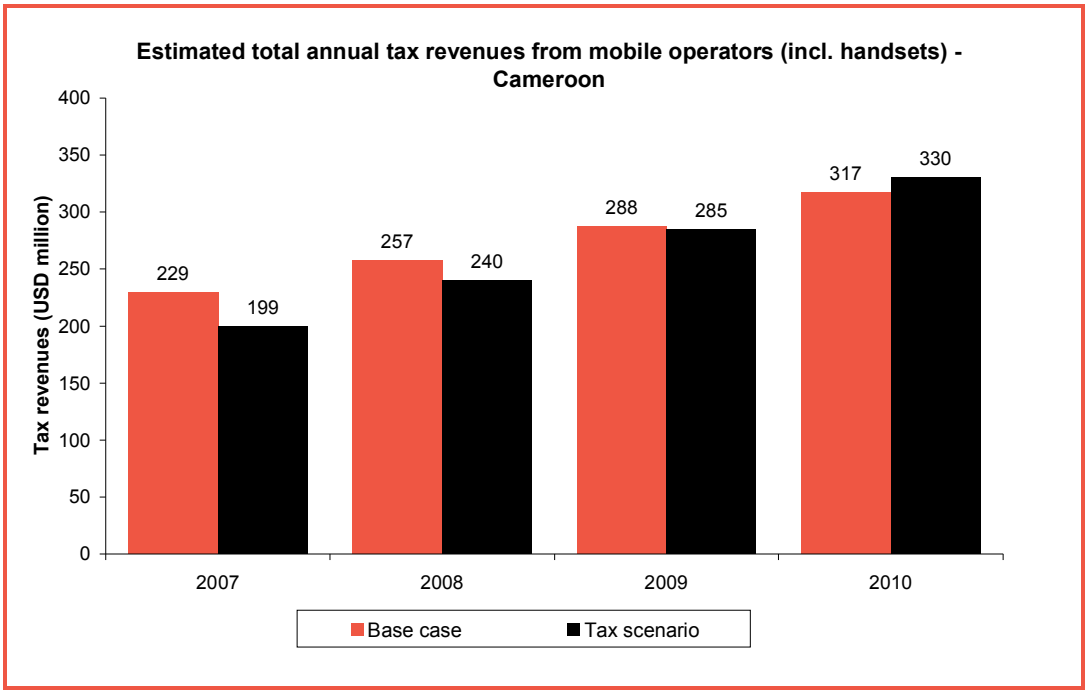


Figure 54: Total annual tax revenues from mobile operator s and handset vendors in Cameroon under the base case and tax scenario 2A (Removal of import duties on handsets)

Source: Frontier analysis

Conclusion

Removing the 31.5% import duty currently levied on imported handsets in Cameroon, may benefit consumers, as participation rates and average usage are expected to increase; operators, who are expected to therefore earn higher revenues; as well as the government, as higher overall tax payments are expected to be made by mobile operators and handset vendors. Increases in penetration could also lead to other, unquantified benefits for the economy, as the greater use of mobile telephony promotes easier communication between individuals and potentially drives productivity gains.

KENYA – TAX SCENARIO 3

Kenya currently has a 10% mobile airtime specific consumption tax. If this was removed, the average cost of mobile usage would fall by an average of 8% across the whole period and the cost of mobile ownership would remain unchanged.

Key results

As a result of the reduction in usage costs due to the removal of the airtime tax in Kenya, average usage per user is expected to increase. Figure 55 presents the projected growth in average annual minutes of use per user under the base case and this tax scenario. In every year, removal of the air time tax would increase average usage.

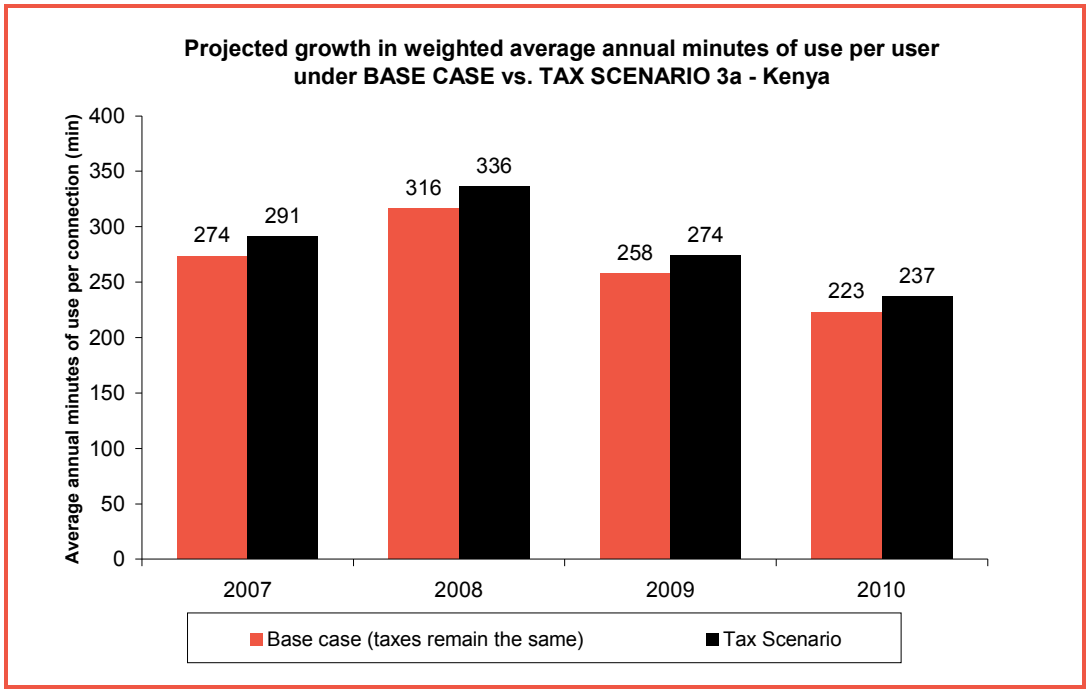


Figure 55: Weighted average annual minutes of use per user in Kenya under the base case and tax scenario 3A (Removal of airtime taxes)

Source: Frontier analysis

In addition to the direct impact on average usage, the reduction in average usage costs may also trigger an (indirect) response in demand for connections, due to the reduction in the overall cost of owning and using a mobile. Figure 56 presents the expected impact of the removal of the airtime tax on mobile penetration. By 2010, penetration would be expected to be approximately 4 percentage points higher than if import duties on handsets were not removed.

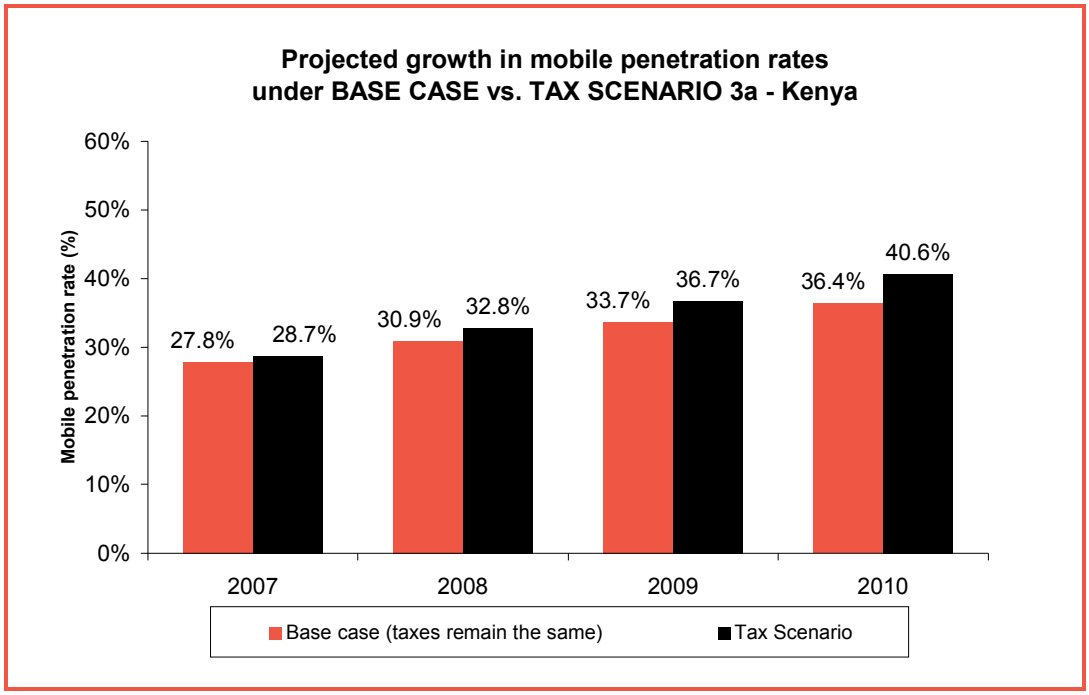


Figure 56: Mobile penetration rates in Kenya under the base case and tax scenario 3A (Removal of airtime taxes)

Source: Frontier analysis

Given the expected increases in average usage and participation, and consistent pre-tax consumer prices, total operator and handset vendor revenues are projected to exceed those under the base case. As shown in Figure 57, total operator revenues in 2010 could be 13% higher under this tax scenario compared to the base case.

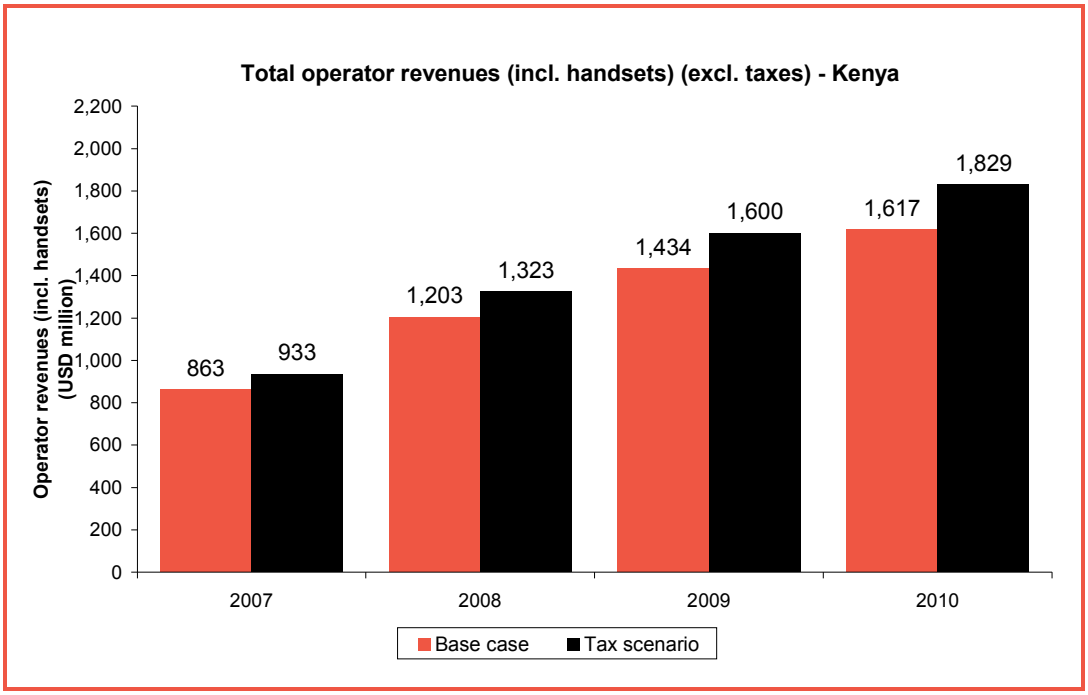


Figure 57: Total operator and handset vendor revenues in Kenya under the base case and tax scenario 3A (Removal of airtime taxes)

Source: Frontier analysis

Figure 58 presents the projected impact of this tax change on tax payments by operators and handset vendors. Removing a specific mobile airtime consumer tax is likely to lead to lower overall tax revenues. This is because the loss of airtime taxes which would have been earned under the base case is such that the increase in connections and average usage that occur because the tax has been removed are not large enough to offset the former effect.

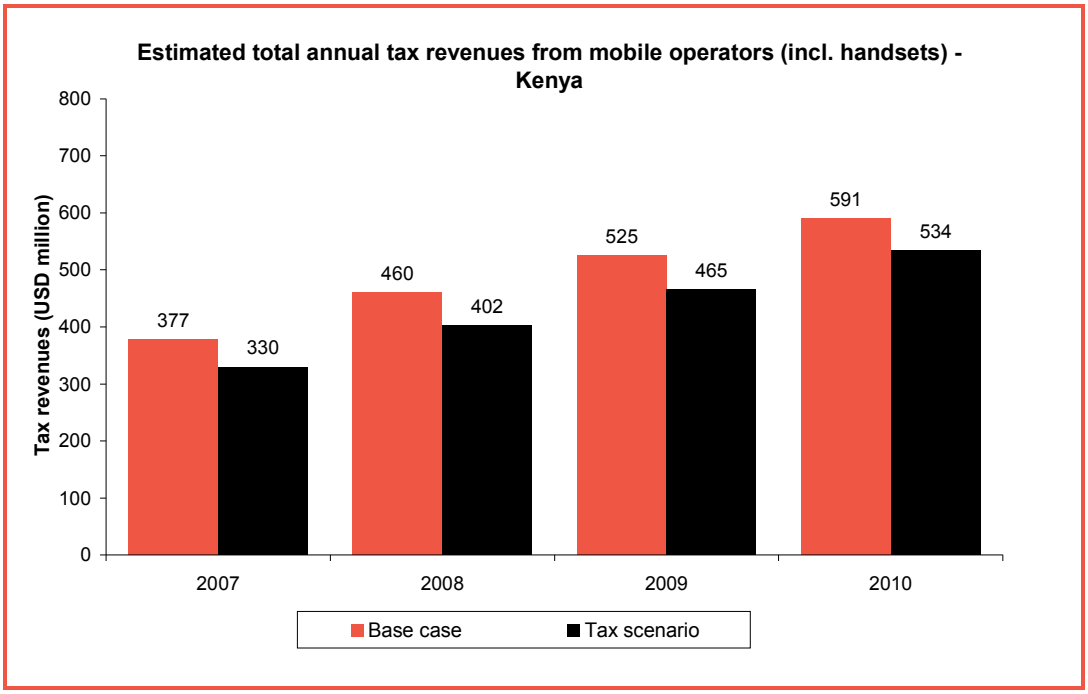


Figure 58: Total annual tax revenue from mobile operators and handset vendors in Kenya under the base case and tax scenario 3A (Removal of airtime taxes)

Source: Frontier analysis

Conclusion

Removing the 10% consumer tax currently levied on mobile airtime in Kenya may benefit consumers as participation rates and average usage are expected to increase; and operators and handset vendors, who are expected to therefore earn higher revenues. In turn, it is possible that this might have other, non-quantified, benefits for the economy, over the time frame considered here (2007 – 2010) the removal of this tax would not be beneficial to the government however, due to the reduction in tax revenues from the mobile industry and handset vendors.

GHANA – GOVERNMENT PROPOSED TAX CHANGES

The government in Ghana has recently proposed the following tax changes relevant to the mobile sector:

- removal of all handset related import duties (10%) and import VAT on handsets (15%); and
- introduction of an air time specific consumption tax of one pesewa per minute (equivalent to approximately US$ 0.01 per minute).

In the following, we present an overview of the expected impact of the proposed changes to the tax regime. We split the impact into two stages:

- Stage 1: Removal of all handset related import duties and input VAT on handsets – in this scenario the cost of ownership is reduced by 19% across the whole period; and

- Stage 2: Removal of all handset related import duties and input VAT on handsets and introduction of the air time specific consumption tax – the cost of ownership is reduced by 19% across the whole period and the cost of usage is increased by 3.4% across the whole period.

Key results

Removing handset import duties reduces the cost of mobile ownership and therefore could significantly improve affordability and penetration. Under Stage 2, penetration is higher than under the base case, but does not reach the same level as when only the import duties on handsets are removed.

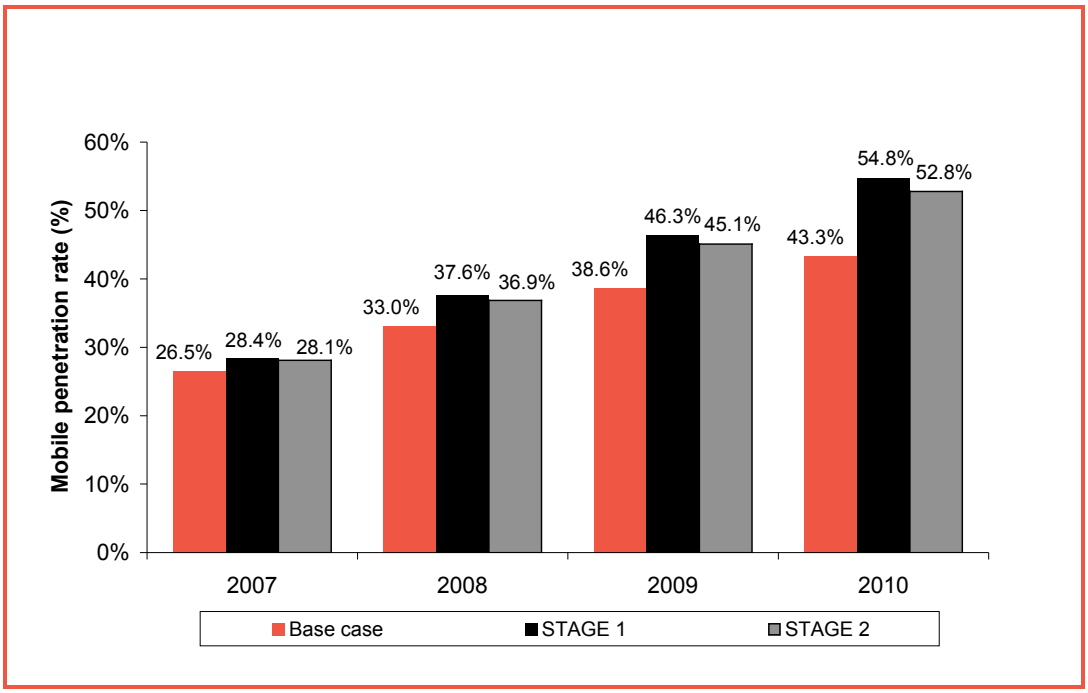


Figure 59: Mobile penetration rates in Ghana under the base case; stage 1 of the proposed tax change and stage 2 of the proposed tax change

Source: Frontier analysis

Overall, minutes of use increase due to the cross-price effect and the network effect (more calls are made as there are more customers on the networks). Under Stage 2, average usage is higher than under the base case, but does not reach the same level as when only the import duties on handsets are removed.

Annexe 4: Tax simulation case studies

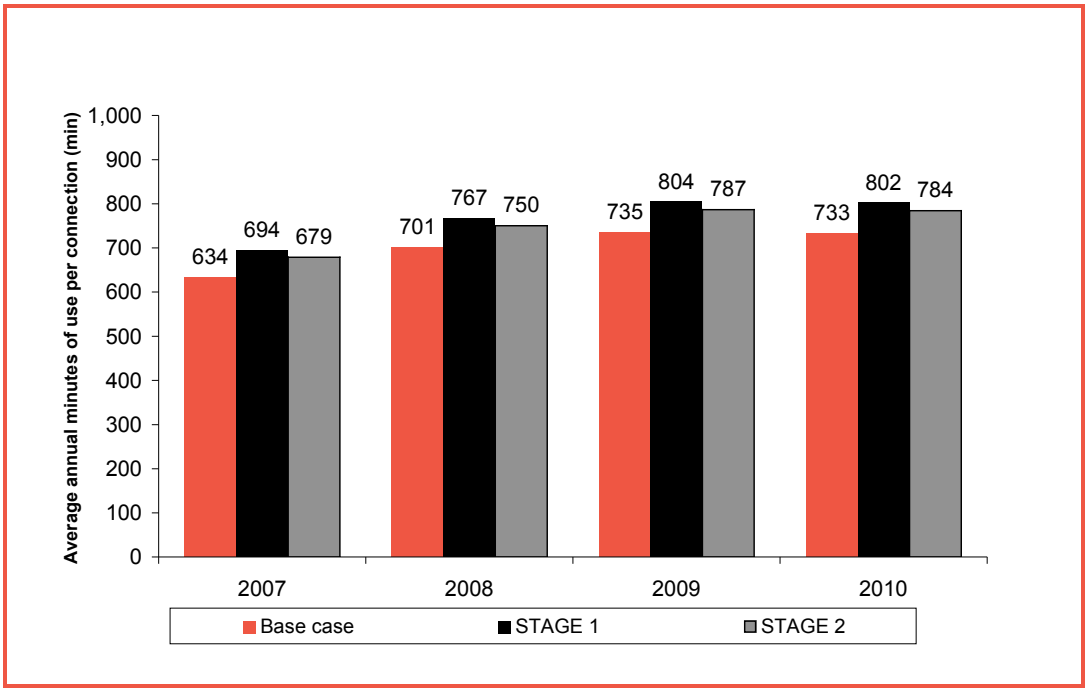


Figure 60: Weighted average annual minutes of use per user in Ghana under the base case; stage 1 of the proposed tax change and stage 2 of the proposed tax change

Source: Frontier analysis

Given the expected increase in average usage per user and participation and consistent pre-tax consumer prices under "stage 1", total operator and handset vendor revenues are projected to exceed those under the base case. However, following the introduction of the airtime tax as well, total operator and handset vendor revenues are expected to decline somewhat, due to the loss of mobile users and slight decline in average usage.

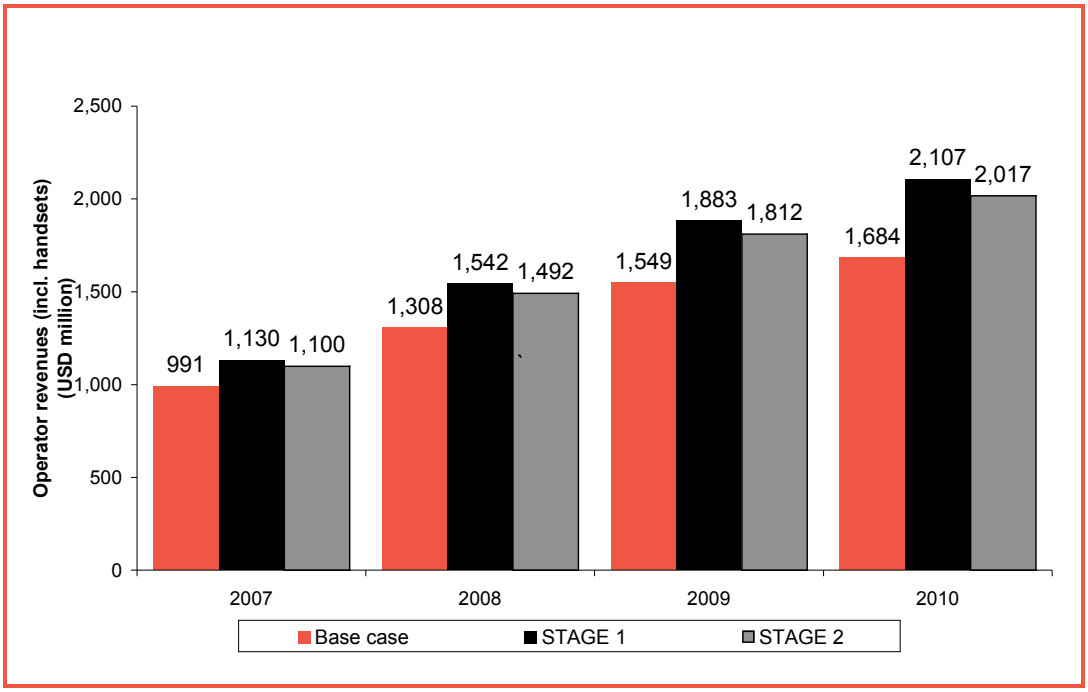


Figure 61: Total operator and handset vendor revenues in Ghana under the base case; stage 1 of the proposed tax change and stage 2 of the proposed tax change

Source: Frontier analysis

The increase in penetration and usage offsets the reduction in handset import duty rates, making this scenario tax positive in every year across the four year period (i.e. total tax payments are expected to increase by up to 24%). By introducing the air time specific tax as well, total tax revenues increase further but by incrementally less than if only handset import duties are removed.

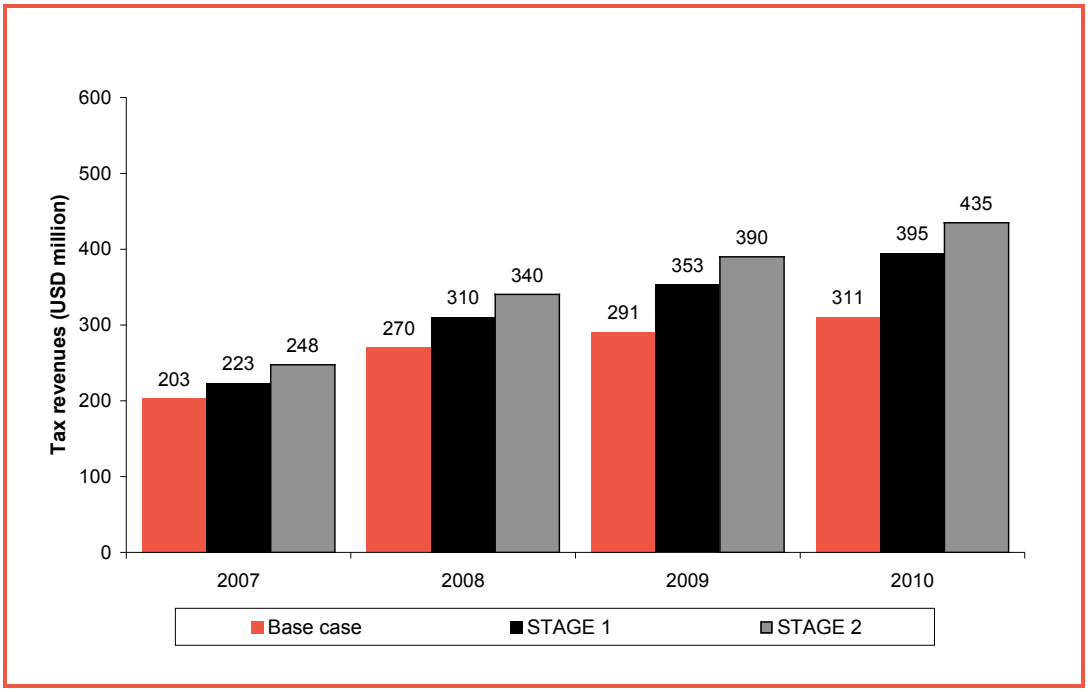


Figure 62: Total annual tax revenue from mobile operators and handset vendors in Ghana under the base case; stage 1 of the proposed tax change and stage 2 of the proposed tax change

Source: Frontier analysis

Conclusion

Removing the handset import duties could have a positive impact on the sector and government tax revenues - affordability of mobile services and penetration are expected to increase significantly and total government tax revenues from the mobile sector could increase by about 24%.

Implementing both tax changes is likely to lead to less favourable results than just removing the import duties on handsets. Total tax payments from the mobile sector will slightly exceed those under "stage 1" of the regime change, although by less than 10% and this will be at the expense of overall participation in the mobile sector and average usage. Because mobile services will be less affordable, mobile penetration and average usage will be lower than under "stage 1".

A significant assumption underlying our results is that the price of a grey market handset will decline by the same proportion as the price of a legitimate handset when the handset import duties and import VAT are removed.

This implies that the relative price of a legitimate and a grey handset remains unchanged and therefore we would not expect consumers to switch from a grey handset to a legitimate handset when they renew their phone. Consequently, the grey market would continue to provide 90% of the handsets sold in Ghana under the proposed tax scenario.

We are aware that one of the main motivations behind the proposed tax change is to reduce the size of the grey market. However, for this to happen the price of

Annexe 4: Tax simulation case studies

a legitimate handset relative to the price of a grey handset would have to decline. Without more detailed information about the way the grey handset market operates it is very difficult to determine how this might feed through. Consequently, the results shown must be considered to be illustrative as they are highly dependent on the assumptions we have made about how the market would react.

Annexe 4: Tax simulation case studies

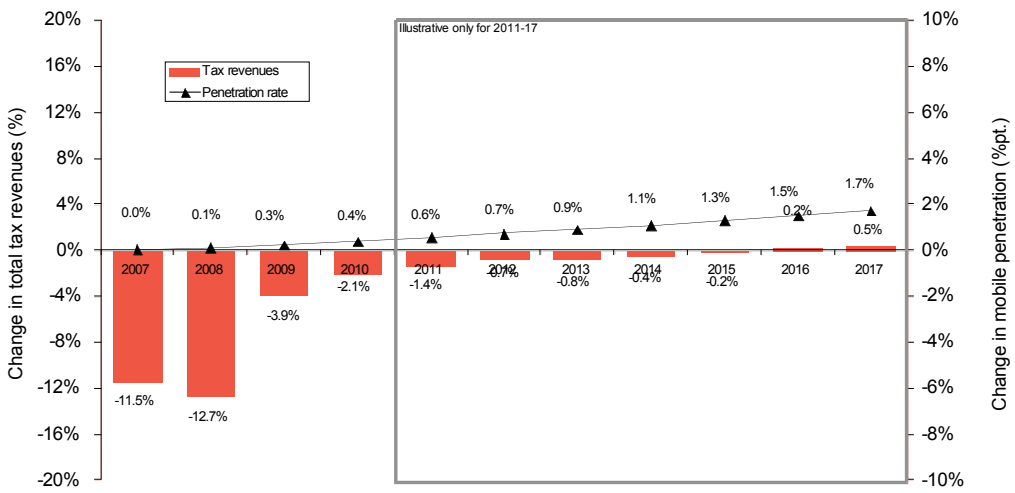
Annexe 5: Selected results from extended model (2007 – 2017)

EFFECT OF A REDUCTION IN TAXES ON IMPORTED NETWORK EQUIPMENT (TAX SCENARIO 1A)

Effect on penetration & tax revenues – Ghana & Republic of Congo

Based on our simulation model, we estimate the effect of removing equipment import duties in Ghana on tax revenues could become neutral on an annual basis 10 years after the initial tax reduction. Because the rate of growth in penetration becomes more pronounced over time, so tax revenues will also increase.

Similar results could be achieved in the case of the Republic of Congo, although because penetration increases more rapidly, tax revenues could become neutral after only six years.



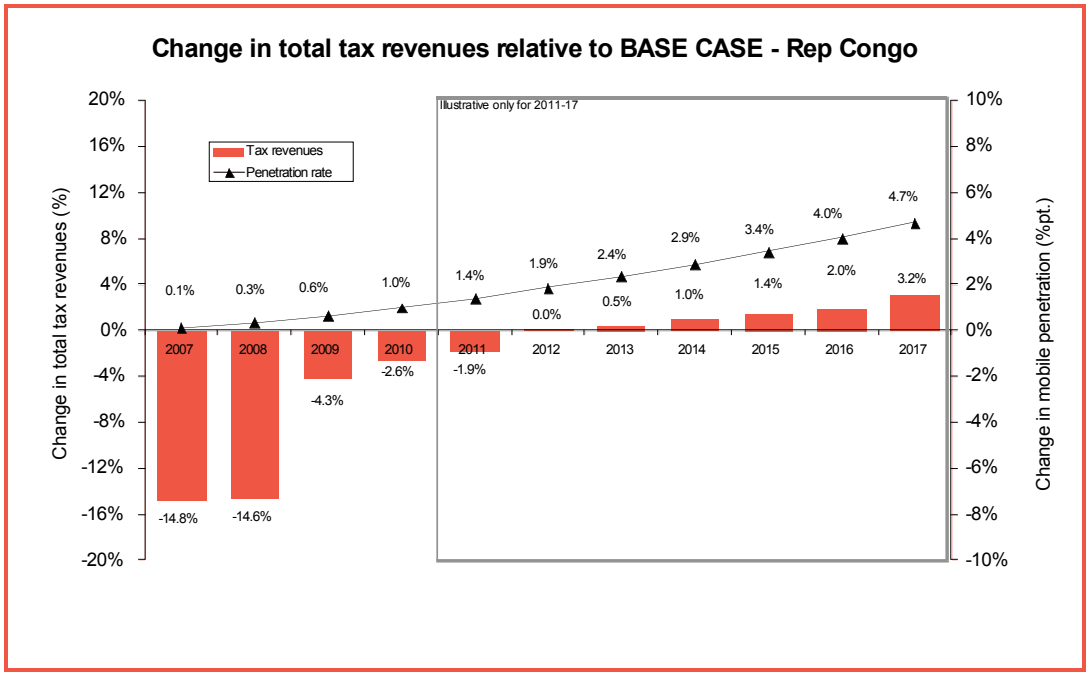


Figure 63: Annual proportionate difference in tax revenues and annual percentage point difference in penetration rates under the base case and tax scenario 1A (Removal of all import duties on network equipment) for Ghana & Republic of Congo

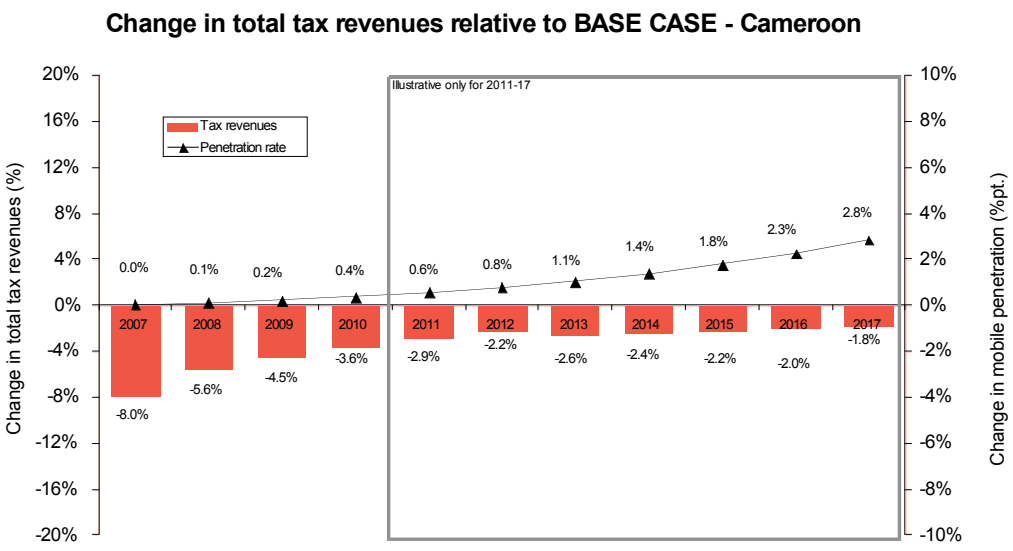
Source: Frontier analysis

Effect on penetration & tax revenues – Cameroon & Malawi

Extending the modelling period to 2017 does not lead to tax neutrality on either an annual basis or from a cumulative perspective in Cameroon. This is in spite of consistent increases in the penetration rate relative to the base case. The same occurs in Malawi.

This is driven by the fact that in generating forecasts of the necessary input data we have assumed that investment (which drives the tax base here) is determined by the number of net additional connections. In both these countries it seems likely that the number of net additions will continue to grow, which is what our forecasts to 2017 assume, and therefore investment will also grow. The direct loss of tax revenue if import duties were removed would therefore be increasing over time (that is, under the base case the tax payments would be growing with the level of investment and therefore the tax loss under the scenario relative to the base case would be increasing) This cannot be offset by the demand effect generated by the removal of the tax which as explained previously will tend to be quite small.

Annexe 5: Selected results from extended model (2007 – 2017)



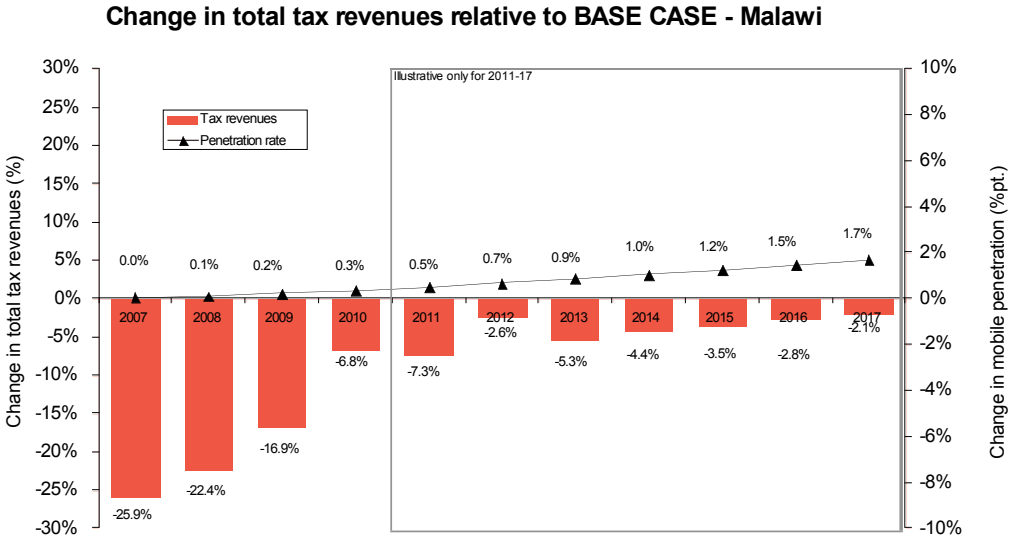


Figure 64: Annual proportionate difference in tax revenues and annual percentage point difference in penetration rates under Base Case and Tax Scenario 1A (Removal of all import duties on network equipment) for Cameroon & Malawi

Source: Frontier analysis

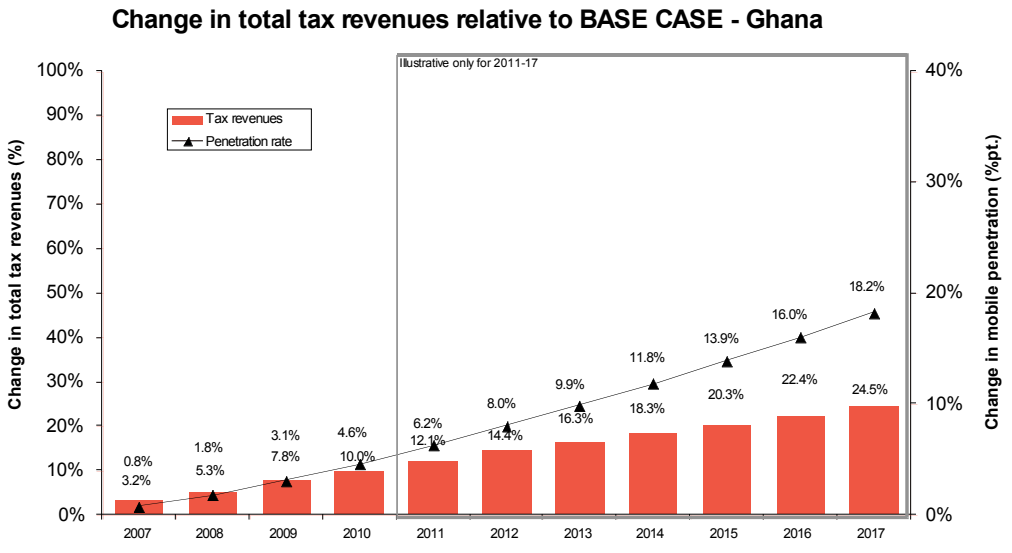
Annexe 5: Selected results from extended model (2007 – 2017)

EFFECT OF A REDUCTION IN TAXES ON IMPORTED HANDSETS (TAX SCENARIO 2A)

Effect on penetration & tax revenues – Ghana & Republic of Congo

Based on our simulation model, we estimate that in Ghana, the removal of these taxes results in a considerable increase in overall tax revenues relative to the base case, with penetration expected to grow at an increasingly faster rate than otherwise forecast (i.e. compared to the base case).

In the Republic of Congo, this is also observed initially but by 2012, under this scenario the market is forecast to have reached saturation point (i.e. 100% penetration). Consequently, the difference in penetration relative to the base case starts to decline, because under the base case penetration is still expected to grow, under the scenario we have capped penetration at 100%. In consequence, tax revenues under the scenario after 2012 become lower than they would be under the base case, because the number of connections no longer grows. This result should be interpreted carefully, as it is obviously dependent on the assumptions we have had to make about how the mobile market in this country will continue to develop further into the future (and specifically, the maximum level of mobile penetration).



Annexe 5: Selected results from extended model (2007 – 2017)

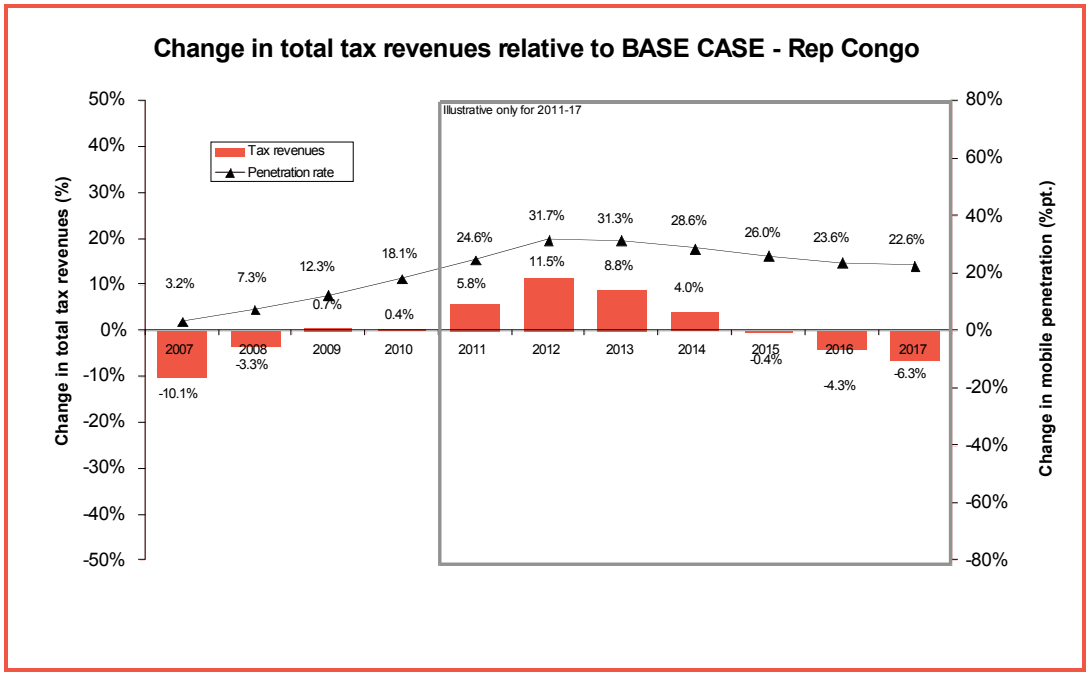


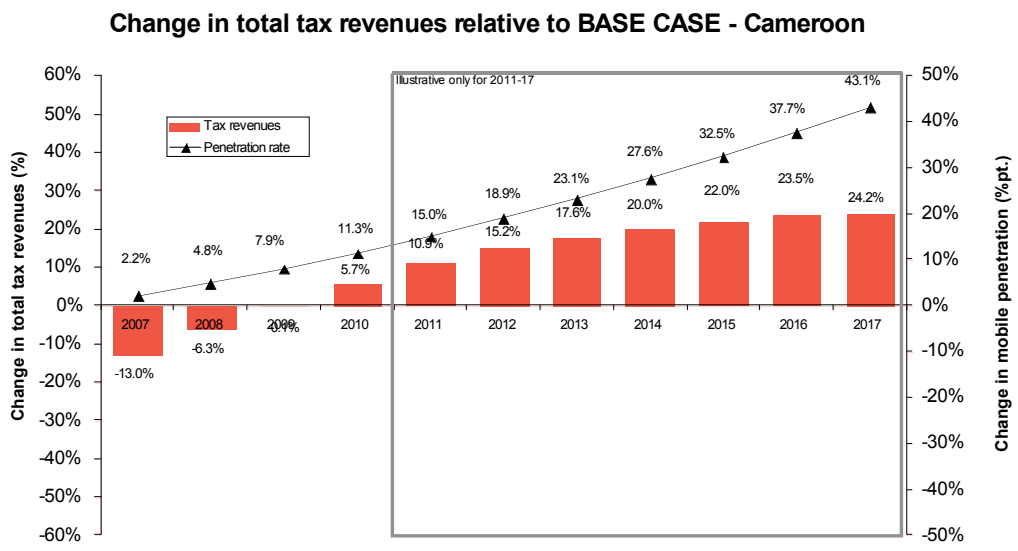
Figure 65: Annual proportionate difference in tax revenues and annual percentage point difference in penetration rates under the base case and tax scenario 2A (Removal of all import duties on handsets) for Ghana & Republic of Congo

Source: Frontier analysis

Effect on penetration & tax revenues – Cameroon & Malawi

For both Cameroon and Malawi, whilst our model indicates that all tax revenues could initially fall the subsequent boost to penetration is enough to offset the fall in tax rates. Therefore, on both an annual and a cumulative basis, this scenario is tax revenue neutral in Malawi by 2013 and by 2012 in Cameroon.

Annexe 5: Selected results from extended model (2007 – 2017)



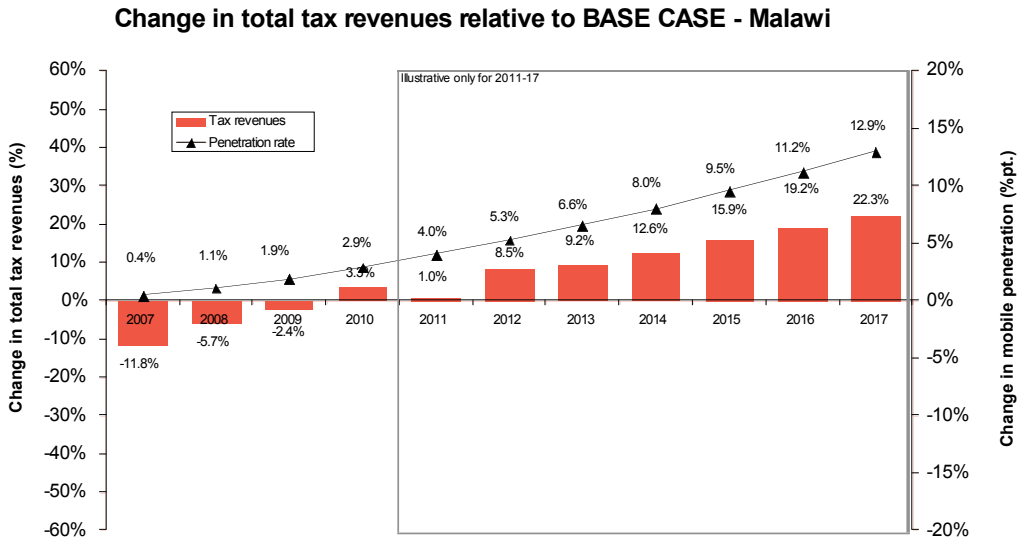


Figure 66: Annual proportionate difference in tax revenues and annual percentage point difference in penetration rates under the base case and tax scenario 2A (Removal of all import duties on handsets) for Cameroon & Malawi

Source: Frontier analysis

Annexe 5: Selected results from extended model (2007 – 2017)

EFFECT OF A REDUCTION IN TAXES ON AIRTIME (TAX SCENARIO 3A)

In the Republic of Congo a small mobile airtime tax exists of 0.9%. None of the other countries for which extended models have been constructed have such a tax, so this scenario is not relevant for them.

Based on the results of our model, removing this airtime tax has a much lesser impact on penetration than removing handset taxes, both because it is only affecting the price of usage and because the tax in question here is very small. Consequently, although tax revenue falls, it does so only by a very small amount. After 10 years, our extended model suggests that this scenario would become tax revenue neutral (on an annual basis) – see Figure 67 below.

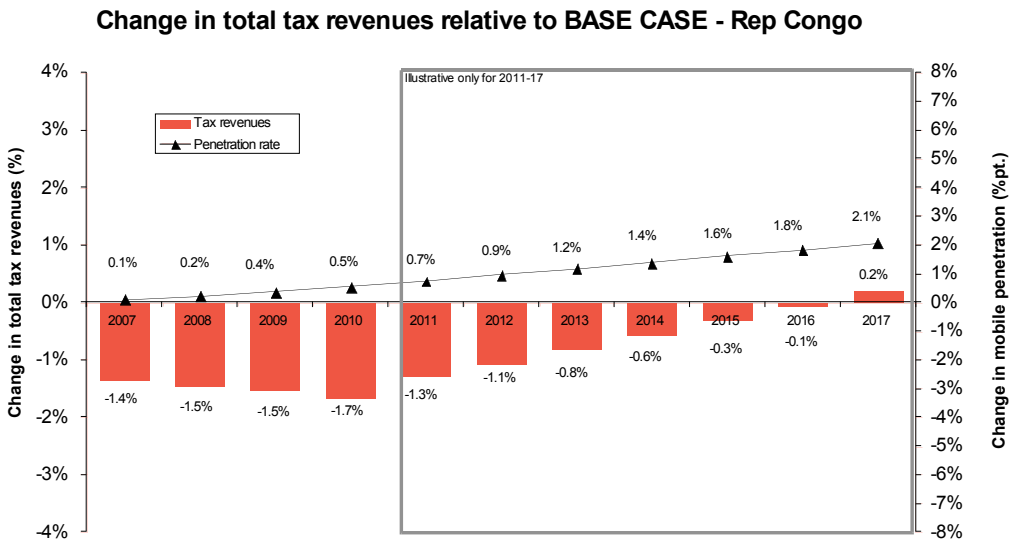


Figure 67: Annual proportionate difference in tax revenues and annual percentage point difference in penetration rates under the base case and tax scenario 3A (Removal of airtime taxes) for Republic of Congo

Source: Frontier analysis

EFFECT OF TAX REGIMES TO IMPROVE AVAILABILITY & AFFORDABILITY OF MOBILE SERVICES (TAX SCENARIO 4)

Note that we only present results for Ghana here because none of the other countries for which extended models have been built charge any additional

Annexe 5: Selected results from extended model (2007 – 2017)

ownership related taxes other than handset import duties (which are dealt with in scenario 2A)[38].

The patterns observed are very similar to those generated by just removing the handset import duties in Ghana (scenario 2A). However, because there are some additional ownership related taxes in Ghana, removing them as well boosts penetration even further.

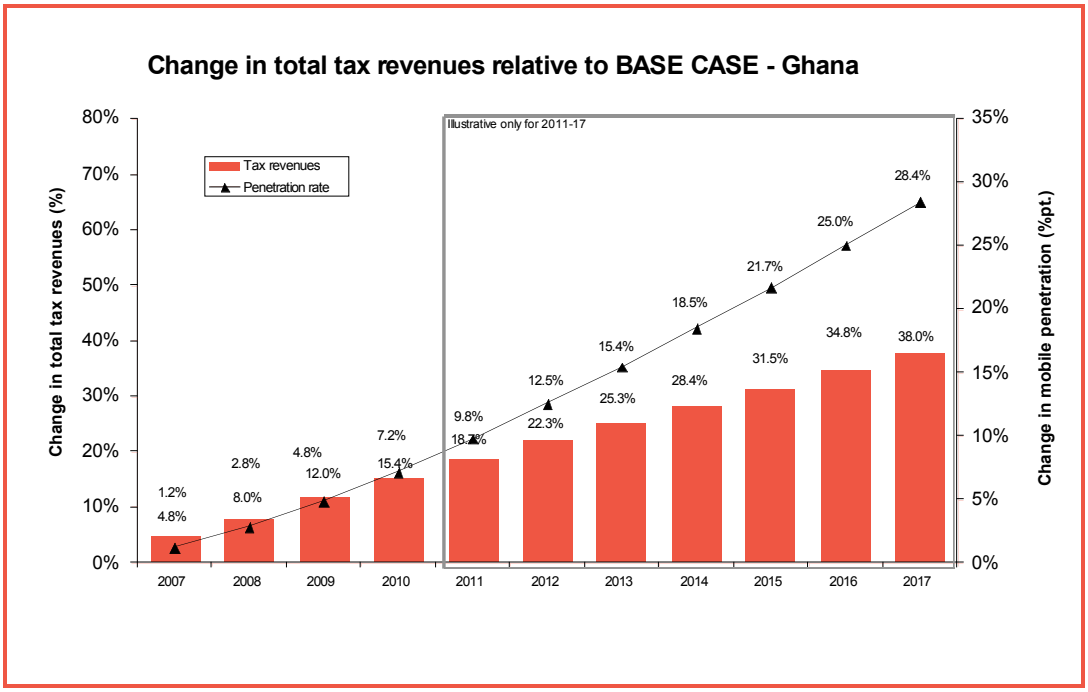


Figure 68: Annual proportionate difference in tax revenues and annual percentage point difference in penetration rates under Base Case and Tax Scenario 4 (Removal of all ownership taxes) for Ghana

Source: Frontier analysis

38 Although there is an additional tax on connections and subscriptions in the Republic of Congo it is only 0.9% and therefore not material enough to make any difference to the results for this relative to those for tax scenario 2A.

Annexe 5: Selected results from extended model (2007 – 2017)

Annexe 6: Operators by country

	Country	Celtel	MTN	Vodacom	Orange
1	Benin		✓		
2	Botswana		✓		✓
3	Burkina Faso	✓			
4	Cameroon		✓		✓
5	Chad	✓			
6	Rep Congo	✓	✓		
7	Cote d'Ivoire		✓		✓
8	DRC	✓		✓	
9	Gabon	✓			
10	Ghana		✓		
11	Guinea Bissau		✓		
12	Guinea Republic		✓		✓
13	Kenya	✓		✓ (Safaricom)	
14	Lesotho			✓	
15	Liberia		✓		
16	Madagascar	✓			✓
17	Mali				✓
18	Malawi	✓			
19	Mozambique			✓	
20	Niger	✓			
21	Nigeria	✓	✓		
22	Rwanda		✓		
23	Senegal				✓
24	Sierra Leone	✓			

25	Swaziland		✓		
26	South Africa		✓	✓	
27	Sudan		✓		
28	Tanzania	✓		✓	
29	Uganda	✓	✓		
30	Zambia	✓	✓		

Table 8: Operators by country

Source: GSMA

Annexe 6: Operators by country

Annexe 7: Limitations of tax simulation modelling

In this Annexe, we describe some of the limitations of the tax simulation modelling.

- When considering the results of the tax simulation it is important that the results are analysed relative to the base case, rather than as absolute figures. This is because the absolute results are heavily dependent on the forecasts which underlie them.[39]
- The scope of the exercise implies that the model that has been used is general enough to be able to assess the impact of different tax scenarios across a wide range of countries within the data limitations present – for example the elasticities used are common across the countries. In considering the results for any individual country therefore, the interpretation should focus on the relative magnitude of the impact of different scenarios, rather than the absolute estimates of tax, which could differ for any individual country very significantly from the outputs of the model.
- In many instances we had to gross up data from a small number of operators in order to generate results which represented the market as a whole, to the extent that operators are not all the same, this could affect the reliability of the model results.
- Our estimates of the amount of tax paid by the mobile operators may not reconcile with the actual amounts paid, as some types of tax have not been included and the effects of any tax planning has not been captured.
- Our estimates of the relevant demand elasticities (and assumption that the same elasticities can be applied across the region) may not be accurate. However, we have performed some sensitivity analysis which suggests that the results are not particularly sensitive to adjustments in the magnitude of these elasticities.
- We have implicitly assumed that in response to a change in mobile specific handset taxes the grey market for handsets will remain a constant proportion of the overall market for handsets. In reality this may not be the case as removing these taxes could reduce the benefit of purchasing a grey-market handset.
- We have not modelled a change in the demand for network equipment in response to a change in the level of import duties and hence price. In reality, there may be a link between the level of actual investment and these taxes.

[39] Note that to devise these forecasts, Frontier has not undertaken a detailed demand assessment.

Annexe 7: Limitations of tax simulation modelling

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