Telecom Advisory Services, LLC

# The Impact of Taxation on the Development of the Mobile Broadband Sector

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# ABSTRACT


The purpose of this study is to assess the impact of taxation on the development of the mobile broadband sector in emerging countries. It is based on case studies of five countries, four of which have enacted fairly heavy taxation regimes (Brazil, Mexico, Bangladesh and South Africa) and one (Malaysia) exhibiting a benign approach. All five countries envision mobile broadband as a key lever to address the digital gap. Disadvantaged economics of fixed broadband, combined with limited diffusion of personal computers renders mobile broadband and 3G phones a highly suited technology to meet the broadband access to internet challenge. However, despite the critical importance of wireless broadband as a key lever to address the broadband gap, all countries with the exception of Malaysia, have implemented a taxation approach which reduces its penetration potential by putting an additional burden on the purchase of handsets and services.

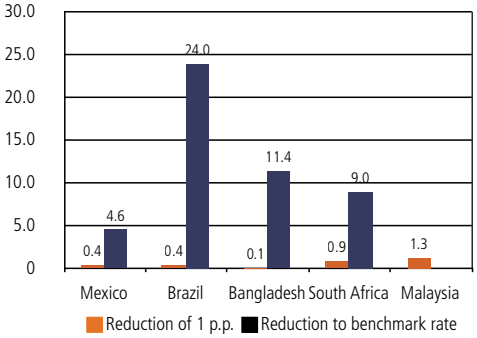
A quantitative analysis of the impact of levies on service adoption and consequently on economic growth concludes that the taxation approaches of South Africa, Mexico, Brazil and Bangladesh will have negative impact on the diffusion of wireless broadband with a consequent detrimental effect on economic development. Given that fixed broadband penetration is underdeveloped in all five countries, mobile broadband is a key lever to foster economic growth. Taxes on mobile services hamper diffusion of this technology. For example, a reduction in taxation in the countries studied to Malaysia's rate could increase wireless penetration between 4.6 and 24 percentage points (see figure below).

The implications for fiscal policy in these and other countries are clear. While it is imperative that governments apply taxes to finance spending and generate externalities in sectors where private investment is lacking, often times these taxation models are not efficient. Fiscal policies that apply a special tax to the telecommunications sector are inefficient and cause distortions that "crowd out" private spending and in the end diminish welfare. The study also identified clear policy inconsistencies between regulations aimed at developing the ICT sector through investment incentives and a policy orientation where ICT services are perceived as "cash cows" upon which taxes are levied.

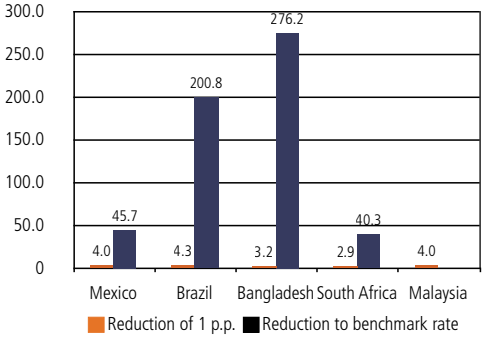
The policy implications of this situation are twofold. Emerging countries need to align taxation approaches affecting mobile broadband with ICT national objectives. If mobile broadband is understood as a key social and economic development lever, taxes cannot represent an obstacle for diffusion. In this context, the study indicates that a reduction in taxes affecting mobile broadband will translate into higher service adoption, which will ultimately generate additional GDP. In other words, for every dollar reduced in taxes, emerging countries will generate additional GDP ranging between US $1.4 and US $12.6. Furthermore, the foregone tax revenues will be partially or totally compensated by taxes collected on a larger GDP.

The issues identified in the case studies are not exclusive to the countries analyzed. At least twenty-seven countries around the globe have adopted highly distorting taxation approaches negatively impacting the development of mobile broadband. It is imperative that policy makers examine this situation to make sure that a proper development framework for ICT and wealth creation in the economy is adopted.


**Increase in Wireless Penetration Resulting from Changes in Taxation (in percentage points)**




**Increase in Wireless User Base Resulting from Changes in Taxation (in percentage)**




Note: Malaysia is considered to be the benchmark at 6.1%

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# Executive Summary

Telecom Advisory Services LLC has been retained by the GSM Association to assess the impact of taxation on the development of the mobile broadband sector. The resulting study comprises the development of a taxonomy of approaches to imposing taxes on mobility services and the assessment of the impact of said approaches on the adoption of mobile broadband services. These estimates serve as a basis to simulate the effect of changes in taxation on mobile broadband penetration and, consequently, on the economy. By estimating the impact of taxes on the diffusion of mobile broadband services and, ultimately on the economy, a set of policy recommendations that can address the need for collecting government revenues while maximizing mobile broadband penetration were developed. The study did not address taxes charged at the corporate level.

A taxonomy of taxation was constructed by compiling all potential levies, both generic and sector specific, that can be imposed on mobile services. Based on a comparative analysis of approaches followed by 102 countries, four alternative mobile service taxation models were identified:

- **Universalization of service**: reduce taxes as much as possible to stimulate wireless adoption; this approach attempts to harmonize objectives of universal service with fiscal policy, recognizing that the policy emphasis should be less on collecting revenues for the state treasury than maximizing diffusion of ICT platforms likely to have an impact on economic growth and consumer welfare (e.g. China)
- **Direct taxation without sector discrimination:** recognizing the distorting effect of sector-specific taxes, this approach comprises higher value-added taxes in order to grow tax revenues, but does not include any wireless telecommunications sector-specific taxes that could potentially introduce a sector distortion (e.g. South Africa)
- **Direct taxation and sector specific taxes:** this approach combines a high value-added tax with sector specific levies (e.g. Argentina, Mexico, and Brazil)
- **Service tax revenue maximization:** this model defines wireless communications as an attractive source of tax revenues, by combining high value-added tax, high sector specific taxes and/or a fixed levy (e.g. Bangladesh and Turkey)

Similarly, alternative approaches to handset taxation were identified:

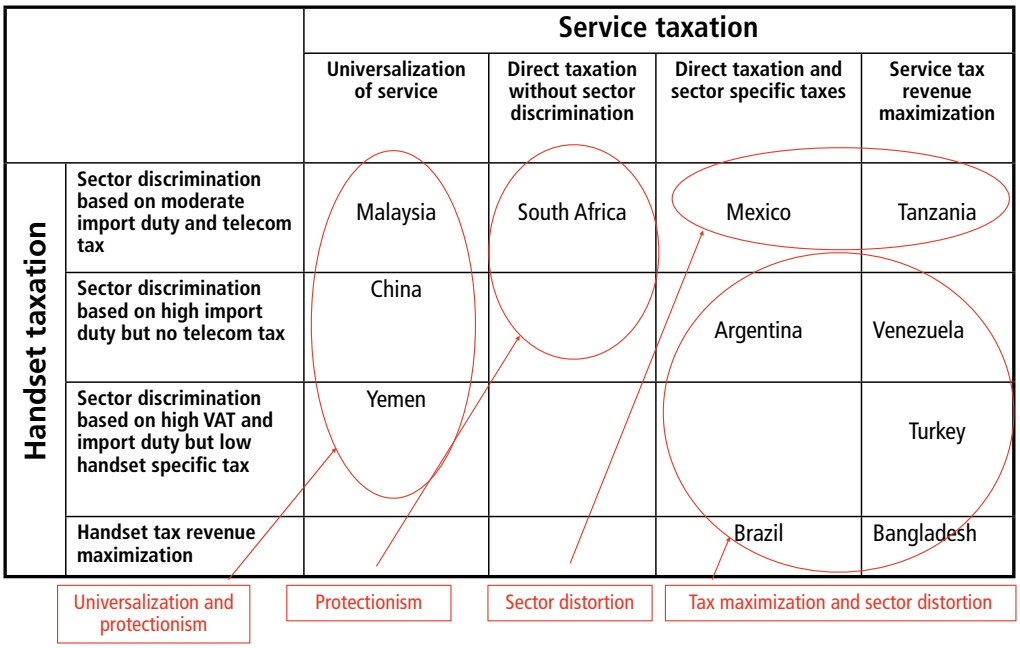
- **Sector discrimination based on moderate import duty:** this approach comprises a value-added tax combined with low duty (e.g. South Africa and Mexico)
- **Sector discrimination based on high import duty but no telecom tax:** this model combines high import duty and value-added tax, but includes no sector specific taxes on handsets (e.g. Argentina)
- **Sector discrimination based on high value-added tax and import duty but low handset specific tax:** this approach combines high value-added tax with a sector specific levy (e.g. Turkey)
- **Handset tax revenue maximization:** this model defines mobile communications as an attractive source of direct taxation, by combining high value-added tax, high customs duty, and a high sector specific levy (e.g. Brazil) or low import duty and high sector specific taxes (e.g. Bangladesh)

By combining the two typologies – service taxation and handset levies – a taxonomy of four approaches to mobile taxation was developed (see Figure A).

The **universalization and protectionism** approach represents a strategy aimed at minimizing taxes in order to maximize wireless service deployment. If it includes a sector specific tax, this is fairly low and, typically, focuses on handsets. At the other end of the spectrum, the **tax maximization and service distortion approach** implicitly recognizes the wireless industry as a primary source of revenues for the treasury and attempts to recover high taxes on both handsets and services, regardless of whether this might have a negative impact on service diffusion or introduce sector distortion. Between the two approaches at opposite ends of the spectrum, the **protectionist** or **sector distortion** models represent moderate approaches that differentiate themselves on the basis of sector specific taxes.

The taxonomy defined above allowed categorizing a sample of 102 countries, from which five were selected to be analyzed as case studies:

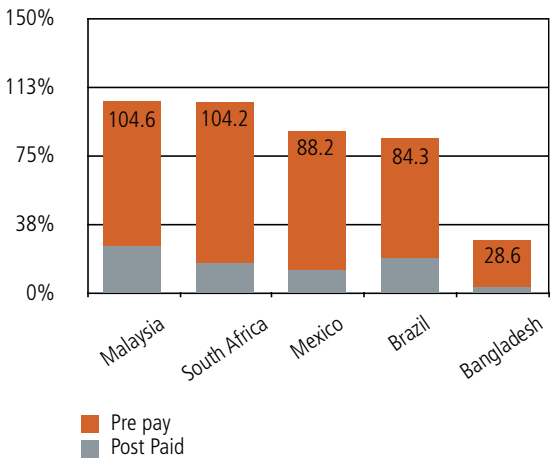
**Figure A. Mobile Service Taxation Approaches**




- Universalization and protectionism: Malaysia
- Protectionism: South Africa
- Sector distortion: Mexico
- Tax maximization and sector distortion: Bangladesh and Brazil

Each of these five countries exhibits a different level of wireless penetration (see Figure B).

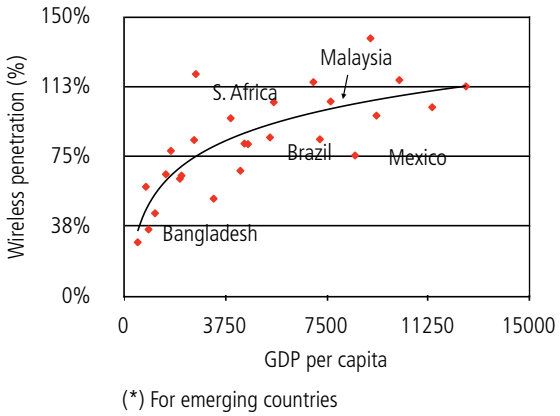
**Figure B. Mobile Penetration (2Q09)**




Source: ITU; Wireless Intelligence; Merrill Lynch; World Bank; TAS analysis

Malaysia and South Africa have succeeded in surpassing 100% penetration in the course of 2009, Mexico and Brazil are approaching the 90%[1], while Bangladesh significantly lags behind. Based on these penetration levels, when regressed against a sample of emerging markets, Bangladesh, Brazil and Mexico appear to have a wireless penetration lagging the size of their economy (see Figure C).

**Figure C. Economic Development and Mobile Penetration (*) (2009)**




(*) For emerging markets
Source: ITU; Wireless Intelligence; Merrill Lynch; World Bank; TAS analysis

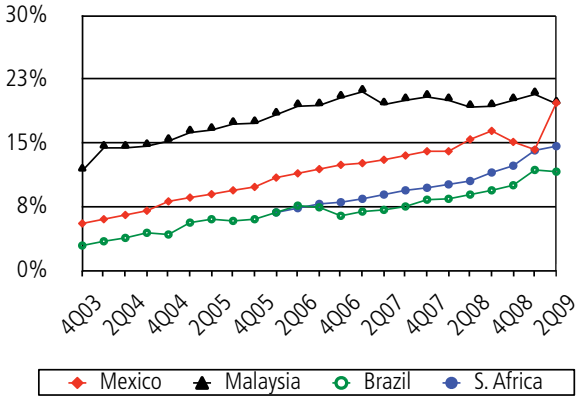
[1] In fact, as of March 2010, Brazil reached 92.5%, while Mexico achieved 87%.

In all five countries, fixed broadband is considerably underdeveloped at the end of 2009. Mexico, the country with highest penetration of all five has a fixed broadband penetration of 28% of households (or 7.05% of population). Malaysia has a penetration of 23% of households (or 4.78% of population), while Brazil has a penetration of 19% of households (or 5.2% of population). At the low end, South Africa has a penetration of 3.9% of households (2% of population) while Bangladesh has a penetration of 0.56% of households (or 0.1% of population).

In this context, all five countries envision mobile broadband as a key lever to address the digital gap. Disadvantaged economics of fixed broadband, combined with limited diffusion of personal computers, renders mobile broadband and 3G phones a highly suited technology to meet the broadband access to internet challenge. Preliminary indications of 3G device adoption, and more importantly, growth in wireless data as a percentage of average revenue per user confirm the importance of wireless broadband across the countries studied (see Figure D).

However, despite the critical importance of wireless broadband as a key lever to address the broadband gap, all countries with the exception of Malaysia, have implemented a taxation approach which reduces its penetration potential by putting an additional economic burden on the purchase of handsets and services. These four countries impose, in addition to the value-added tax, a customs duty on handsets (all of them), specific taxes on service (Mexico, Brazil and Bangladesh) or handsets (Brazil and Bangladesh). On the other hand, Malaysia, a country following the universalization and protectionism approach, has adopted a minimalist tax burden of 5% value-added tax on services and 10% value-added tax on handsets. The approach does not introduce any sector specific distortion levy and keeps VAT to a minimum level (see Figure E).

**Figure D. Mobile Data as a percentage of wireless service revenues (2003-2009)**




Note: While in Bangladesh 3G spectrum licenses will be awarded in 2010, it is estimated that 15 % of the mobile handsets are 3G enabled
Source: Merrill Lynch; TAS analysis

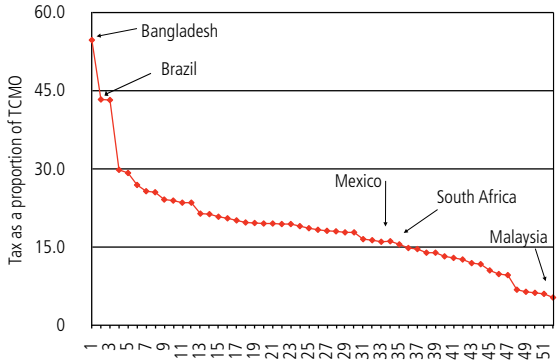
**Figure E. Taxation Approach to Wireless Services in the five countries under study**

| Country | Services | | | Handset | | | | Taxation Approach |
|---|---|---|---|---|---|---|---|---|
| | VAT | Other Taxes | Fixed Taxes | VAT | Customs Duty | Other Taxes | Fixed Taxes | |
| **Malaysia** | 5% | - - - | - - - | 10% | - - - | - - - | - - - | Universalization and protectionism |
| **South Africa** | 14% | - - - | - - - | 14% | 7.60% | - - - | - - - | Protectionism |
| **Mexico** | 16% | 3% (*) | - - - | 16% | 0.10% | - - - | - - - | Sector distortion |
| **Brazil** | 33% | 5.1% | - - - | 33% | 19% | 9.30% | $13.35 | Tax maximization and sector distortion |
| **Bangladesh** | 15% | 35% | $11.76 | 15% | 12% | - - - | $11.63 | |

(*) Applies to all telecommunications services except for fixed and mobile broadband
Source: Deloitte (2008); updated by TAS

The taxation approaches of all five countries have been positioned along the distribution of Total Cost of Mobile Ownership (see figure F).

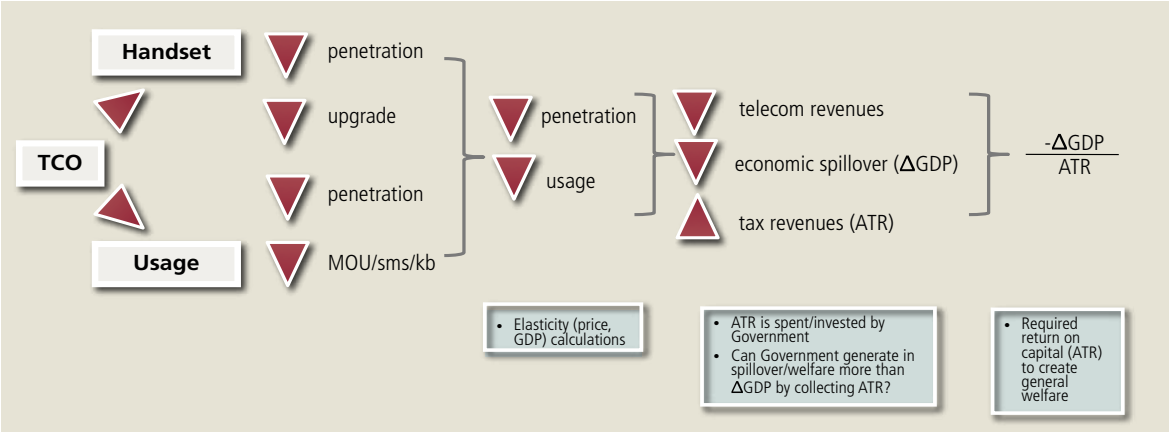
**Figure F. Tax percentage of total cost of ownership of mobile services**




Source: Deloitte (2008); updated by TAS

The approaches of Bangladesh, Brazil, Mexico and South Africa are having a negative impact on the diffusion of wireless broadband with a consequent detrimental effect on economic growth. The economic impact of the current tax structure of all four countries was estimated following a structured approach. Based on a range of estimates of demand elasticity, an economic model calculated the positive impact on wireless diffusion that a reduction of the tax burden could yield, and assessed the incremental impact on the economy. Additionally, the study calculated the taxes that would be lost if the taxation approach were to be modified according to two cases: 1) reduce total taxes by 1 percentage point, and 2) implement a taxation approach following the Malaysia benchmark of 6.1% on Total Cost of Mobile Ownership. As the following paragraphs show, in all the cases analyzed, the wealth creation generated by the lowering of taxes was higher than the accumulated loss in tax collection given the positive spillover effects of broadband diffusion. Moreover, given the low efficiency of government spending in developing countries, the alternative use of collected taxes would result in an even lower overall GDP (see figure G).

**Figure G. Overall impact on economic welfare**




Two assumptions are critical to these estimates; first, what is the impact of broadband on economic growth? And second, what is the estimated level of efficiency that governments can achieve in reinvesting tax dollars to generate commensurate economic welfare?

First, when it comes to economic impact, we have ranged the estimates based on the results of three studies:

- A model specified by the authors for the purposes of this study which is based on a cross-sectional sample of 24 emerging countries (Latin America and the Caribbean), estimates that a 10 % increase in broadband penetration yields a 0.17 % increase to GDP growth[2]
- A model estimating the economic impact of wireless which concludes that 0.6 additional percent points of GDP growth are caused for every 10 percentage points of penetration (Waverman et al., 2005)

[2] We believe this model to be consistent with the recent study validating the "critical mass" theory of broadband economic impact which concludes that for less developed European countries, a 10% increase in broadband penetration results in 0.08 percentage points of GDP growth (see Appendix C)

- A study conducted by the World Bank (Qiang et al., 2009) that concludes that for low and middle income economies, 10 percentage points penetration of broadband will result in 1.38 additional p.p. in economic growth.

Second, as it is almost impossible to estimate the spill over effects of marginal government spending, we use as a proxy the "Government Effectiveness Index" published by the World Bank. It captures perceptions of the quality of public services through surveys applied to 14 sources[3], and measures quality of the civil service and the degree of its independence from political pressures, quality of policy formulation and implementation, and the credibility of the government's commitment to such policies[4]. Its range is from –2.5 to 2.5, where 2.5 is maximum effectiveness of a government.

Based on the results of the model defined and a set of country specific assumptions[5], the following estimates of accumulated effects by 2014 of reducing taxes by 1 percentage point have been calculated:

**1. Mexico:** For every dollar that wireless and non wireless-sector taxes are reduced over the 5 year period ending in 2014, 5.9 to 37.7 dollars will be created in additional GDP[6]. The effect of lowering taxes on Total Cost of Mobile Ownership from the current 16.1% to 15.1% will have the following cumulative effects:

- Additional wireless penetration: 0.3-0.5 %, representing 2.6%-5.3% additional subscribers (or 300,000-600,000)
- Wealth creation (accumulated GDP): $0.6 – $2.4 billion (0.01-0.03% additional GDP by 2014)
- Accumulated loss/gain in tax collection: on the most conservative case, loss of $ 42 million; on the most positive case, gain of $155 million

**2. Brazil:** For every dollar that taxes are reduced over the 5 year period ending in 2014, 4.4 to 91.4 dollars will be created in additional GDP. The effect of lowering taxes on Total Cost of Mobile Ownership from the current 43.3% to 42.3 % will have the following cumulative effects:

- Additional penetration: 0.3 %-0.5 %, representing 2.1 %-4.2 % additional subscribers (or 520,000-1,050,000)
- Wealth creation (accumulated GDP): $0.7-$3.4 billion (0.1-0.7% additional GDP by 2014)
- Gain in tax collection: $115 million-$1.27 billion

**3. South Africa:** For every dollar that taxes are reduced over the 5 year period ending in 2014, 1.9 to 24.9 dollars will be created in additional GDP. The effect of lowering taxes on Total Cost of Mobile Ownership from the current 14.9% to 13.9% will have the following cumulative effects:

- Additional penetration: 0.6%-1.2%, representing 2.6%-5.3% additional subscribers (or 310,000-620,000)
- Wealth creation (accumulated GDP): $138 million-$1.34 billion (0.1-0.17% additional GDP by 2014)
- Accumulated loss/gain in tax collection: on the most conservative case, loss of $37 million; on the most positive case, $303 million

**4. Bangladesh:** For every dollar that taxes are reduced over the 5 year period ending in 2014, 0.6 to 4.5 dollars will be created in additional GDP. The effect of lowering taxes on Total Cost of Mobile Ownership from the current 54.8 to 53.8% will have the following cumulative effects:

[3] Examples of sources are Economist Intelligence Unit, Business Environment Risk Intelligence, WEF, World Bank

[4] Among many other criteria, it explicitly captures the efficiency of fiscal policy, and thus, can be considered as a guideline on how well governments will spend taxation on telecommunications services. It also captures the efficiency of fiscal policy (taxes and spending) as it identifies the effect of the following variables:

- Consistency between planning and spending execution
- Efficiency of revenue mobilization / public expenditures
- Budget management
- The efficiency of the country's tax collection system

[5] See Appendix E

[6] The wide range of revenue gains is due to the fact that foregone taxes are compensated with taxes on sector growth due to lower taxation plus the economic spill-over of broadband

- Additional penetration: 0.1%-0.2%, representing 1.9%-3.9% additional subscribers (or 137,000-277,000)
- Wealth creation (additional GDP): $11.4 million-$53 million (0.01-0.04% additional GDP by 2014)
- Accumulated loss/gain in tax collection: on the most conservative case, loss of $ 21 million; on the most positive case, $ 5 million

**5. Malaysia:** For every dollar that taxes are reduced over the 5 year period ending in 2014, 1.7 to 25.6 dollars will be created in additional GDP. The effect of lowering taxes on Total Cost of Mobile Ownership from the current 6.1% to 5.1% will have the following cumulative effects:

- Additional penetration: 0.9 %-1.8 %, representing 2.9 %-5.8 % additional subscribers (or 260,000-530,000 subscribers)
- Wealth creation (additional GDP): $105 million-$1.44 billion (0.01-0.24% additional GDP by 2014)
- Accumulated loss/gain in tax collection: on the most conservative case, loss of $ 48 million; on the most positive case, $ 156 million

In summary, given that fixed broadband penetration is underdeveloped in all five countries mobile broadband is a key lever to develop the ICT sector. Taxes on mobile services hamper diffusion of this technology, with impact being highest in Brazil and lowest in Malaysia. Mexico's taxation model of mobile services follows the "sector distortion" approach, with a significant impact being achieved on wireless broadband diffusion and, consequently on the economy. In South Africa, the share of taxes in the overall cost of mobile ownership is low (under the developing countries average), while in Bangladesh, the share of taxes is high (very close to Brazil's level and above the average in developing countries). Only Malaysia combines a pro ICT tax approach, with the implementation of a telecommunications development strategy.

The implications for fiscal policy in these and other countries are clear. While it is imperative that governments apply taxes to finance spending and generate externalities in sectors where private investment is lacking, often times these taxation models are not efficient. Developing countries, in particular, face high public funds costs because they implement distorting taxation approaches (Laffont, 2005). Countries need to adopt efficient non-distorting tax policies so as to minimize deadweight losses that may lower their overall national output.

Fiscal policies that apply a special tax to the telecommunications sector are inefficient and cause distortions that "crowd out" private spending and, in the end, diminish welfare. Private investment in ICT has a strong positive impact on growth and there is robust empirical evidence that suggests that taxation of mobile services appears to have a strong negative impact on the deployment of mobile broadband.

Moreover, we found clear policy inconsistencies between regulations aimed at developing the ICT sector through investment incentives and a culture where ICT firms are perceived as "cash cows" and thus taxes are levied. These inconsistencies may be a result of differences in the various agencies' programs. There appears to be a lack of ICT policy leadership at the highest level that would give coherence to ICT development programs. While effects vary by country, adopting similar levels of taxation as Malaysia could create significant wealth with a relatively low cost to the tax collector.

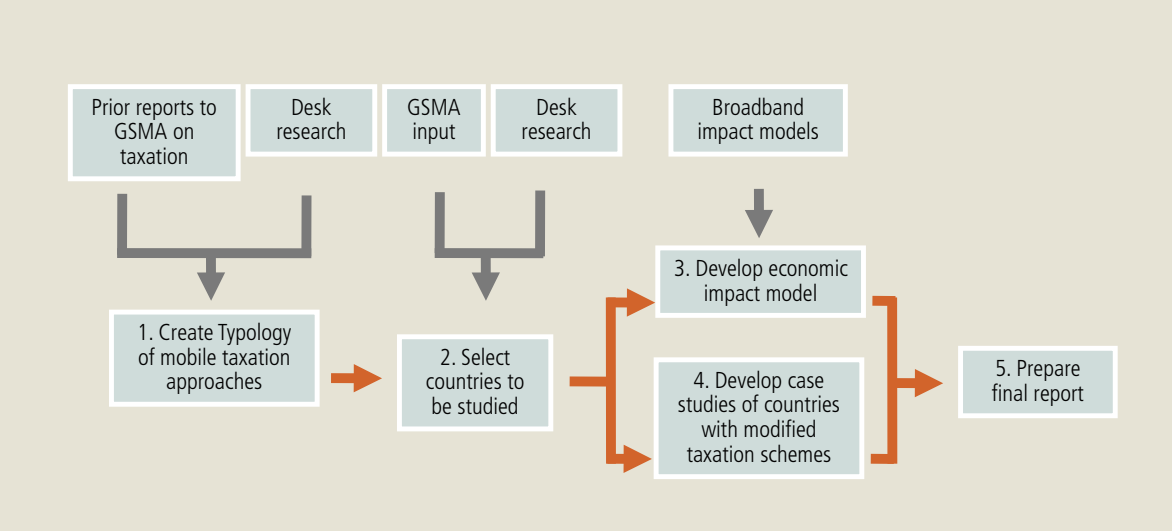

TIME = MONEY
TIME = MONEY
TIME = MONEY
FINANCE

# 1. Background And Study Objectives

Telecom Advisory Services LLC was retained by the GSM Association to assess the impact of taxation on the development of the mobile broadband sector. The objectives of the study were fourfold. First, a taxonomy of approaches to imposing taxes on mobility services was to be developed. Second, the potential impact of said approaches on the adoption of mobile broadband services was to be quantitatively assessed. Third, by relying on economic impact models, the effect of changes in taxation on mobile broadband penetration and, consequently, on the economy were to be estimated. Fourth, based on this understanding, a set of policy recommendations that can address the need for government revenues while maximizing mobile broadband penetration (assuming that the total elimination of taxes is neither feasible nor possible) was to be defined.

In accordance with these objectives, a study approach was structured around five steps (see Figure 1):

**Figure 1: Study approach**




By relying on prior reports to the GSM Association[7], and conducting desk-based research to complement and update this information, a taxonomy of mobile taxation approaches (VAT, handset import duties, telecommunications services, etc.) was created. The construction of this taxonomy was supported by a database of tax approaches across 102 countries[8]. To construct this database, we relied on Deloitte's Tax review (2006-7) as a base start, updated information on 23 countries (Bangladesh, India, Pakistan, Sri Lanka, Cambodia, Indonesia, Rep Congo, Cameroon, Chad, Malawi, Burkina Faso, DR Congo, Madagascar, Guinea, Gabon, Zambia, Nigeria, South Africa, Tanzania, Uganda, Kenya, Mexico, Brazil, and Argentina), defined a framework for determining common taxation approaches and built a database of worldwide taxation approaches. Based on this taxonomy, countries that represent each approach were selected, attempting to preserve a geographic representation. In particular, the selection of case studies emphasized countries where mobile broadband represents a key technology to fill up the supply gap left by fixed platforms (Brazil, Malaysia, Mexico, South Africa and Bangladesh).

Once the case studies were selected, we conducted a cross-sectional analysis of country studies and developed a model explaining the impact of taxation and other variables on mobile data services and 3G adoption. We then estimated the overall economic impact. For this purpose, we relied on our prior work on the impact of taxation on telecommunications services (Galperin and Katz, 2009; Mariscal and Flores, 2009), prior research conducted for the GSM

[7] In particular, Deloitte. Global Mobile Tax Review 2006-2007, Frontier Economics. Taxation of Mobile services in Sub-Saharan Africa 2008, Deloitte. Taxation and the growth of mobile in East Africa (2007) and AT Kearney. Asia Pacific Mobile Observatory (2009)

[8] See Appendix B

Association (Deloitte, 2008; Frontier Economics, 2008) and the work conducted on broadband economic impact (Katz, 2009a; Katz, 2009b; Katz, 2009c; Katz and Suter, 2009; Katz et al, 2010; Katz, 2010; Lehr et al., 2005; Crandall et al, 2007, among others).

In parallel with the modeling exercise, a country -Malaysia- where the tax approach has been modified to maximize service deployment while meeting the treasury objectives was studied; this case was used to formulate policy recommendations which were tested in terms of their impact by relying on the models developed in work step 3. Based on these results, the final report and presentation were prepared.

## 2. A Typology Of Mobile Taxation

The total cost of ownership of mobile telecommunications, which comprises acquisition and recurring charges, is impacted by numerous taxes. On the services side, three exist:

- **Value added tax:** most countries impose some form of value-added tax, a general sales tax or similar consumption tax as a percent of the total bill
- **Telecom specific taxes:** some countries charge an additional special communications tax as a percent of the service bill
- **Fixed taxes:** in addition to the tax as a percentage of usage, some countries charge a fixed tax that could be either driven by general communications usage or wireless usage

In addition to service-based taxes, other levies can be imposed on handsets:

- **Value-added tax:** these represent the taxes paid directly by the consumer at time of purchasing a subscription or handset, as well as when exchanging the device
- **Customs duty:** this tax is already included in the retail price of the handset
- **Other taxes:** telecommunications specific taxes on handsets (e.g. royalties calculated on the cost of handset)
- **Fixed taxes:** special fixed duties on handset, such as ownership fees

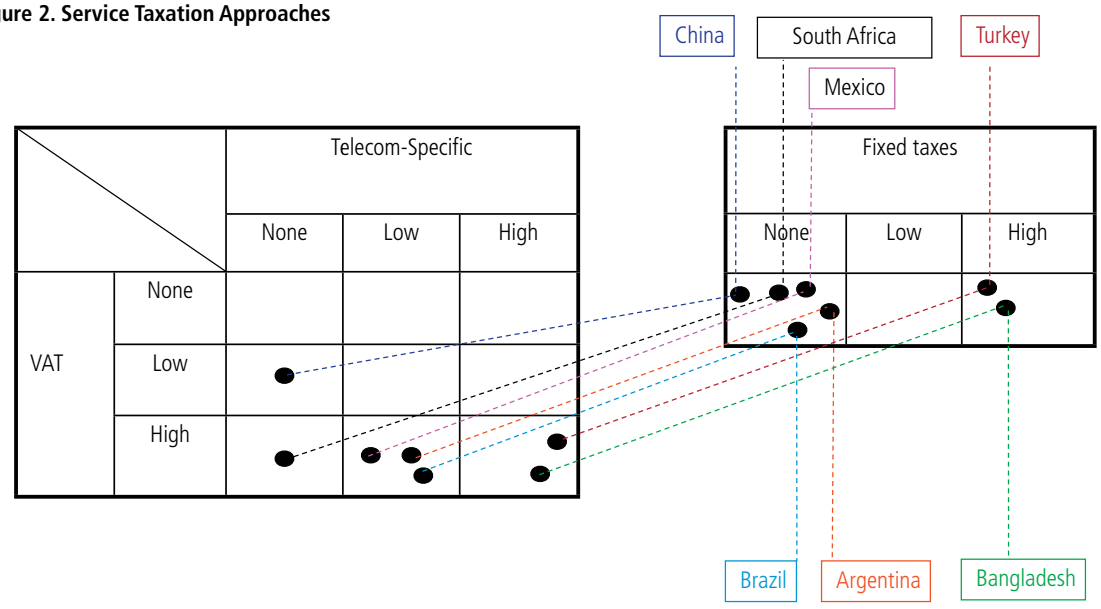
Countries do not follow a uniform approach to mobile services taxation[9]. While all countries tax both services and handsets, the type of taxes selected and their amount vary significantly, with the consequential varying impact on total cost of ownership of a mobile device. Handset taxes increase the acquisition cost and service taxes the recurring expenses.

A scan of service taxation approaches across 102 countries yields several approaches which can be clustered around four categories:

- **Universalization of service:** reduce taxes as much as possible to stimulate adoption (Malaysia, China)
- **Direct taxation without sector discrimination:** impose high value-added taxes while avoiding the distortion effect of sector-specific taxes (South Africa)
- **Direct taxation and sector specific taxes:** combine value-added tax with a sector specific levy (Argentina, Mexico, Brazil)
- **Service tax revenue maximization:** leverage mobile communications as a source of direct taxation, by combining high value-added tax, high sector specific taxes and/or a fixed levy (Bangladesh, Turkey)

The differences across these approaches can be visualized in Figure 2.

**Figure 2. Service Taxation Approaches**




[9] See all raw data on taxation approaches by country in Appendix B.

While most developed and some developing nations reduce service taxes to promote universalization of service, the pattern is not consistent across emerging countries. For example, the Africa and Asia Pacific continents comprise numerous nations with taxation approaches aimed at universalizing mobile services, while this approach is significantly less prevalent in Latin America (see Figure 3).

**Figure 3. Service Taxation Approaches by Country**

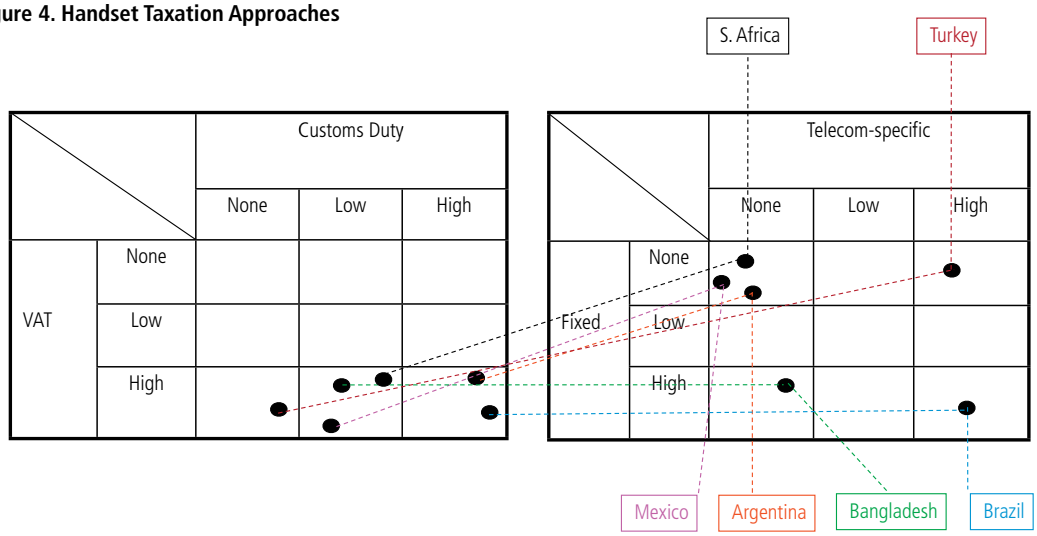
| Continent | Universalization of service | Direct taxation without sector discrimination | Direct taxation and sector specific taxes | Service tax revenue maximization |
|---|---|---|---|---|
| Africa | Angola, Botswana, Lesotho, S. Leone, Swaziland | Cameroon, Chad, Cote d'Ivoire, DR Congo, Egypt, Ethiopia, Gabon, Gambia, Guinea, Guinea Bissau, Malawi, Mauritania, Mauritius, Morocco, Mozambique, Rwanda, Seychelles, S. Africa, Zimbabwe | Burkina Fasso, Ghana, Nigeria, Rep. Congo, Tunisia | Kenya, Madagascar, Senegal, Tanzania, Uganda, Zambia |
| Middle East | Syria, Yemen | | Iran, Jordan | Turkey |
| Asia Pacific | Bhutan, China, Indonesia, Lao, Malaysia, Myanmar, P. N. Guinea, Thailand, Vietnam | India, Philippines, Samoa | Cambodia, Sri Lanka | Bangladesh, Nepal, Pakistan |
| Latin America | Paraguay | Bolivia, Chile, Guatemala, Nicaragua, Peru, Trinidad & Tobago | Argentina, Brazil, Colombia , Mexico | Dominican Republic, Ecuador, Venezuela |
| Eastern Europe | | Azerbaijan, Georgia, Kazkhstan, Russia, Uzbekistan | | Albania, Ukraine |
| Western Europe | Austria, Bulgaria, Cyprus, Czeck Rep., Denmark, Estonia, France, Finland, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK | | | Greece |

Proceeding now to handset taxation approaches, four types can be identified, partly driven by the existence or not of import duties:

- **Sector discrimination based on moderate import duty:** value-added tax combined with low duty (S. Africa, Colombia and Mexico)
- **Sector discrimination based on high import duty but no telecom tax:** high import duty and value-added tax but no sector specific taxes on handsets (Argentina)
- **Sector discrimination based on high VAT and import duty but low handset specific tax:** combine high value-added tax with a sector specific levy (Turkey)
- **Handset tax revenue maximization:** leverage mobile communications as a source of direct taxation, by combining high value-added tax, high customs duty and a high sector specific levy (Brazil) or low import duty and high sector specific tax (Bangladesh)

Again, the differences across these four approaches can be visualized in Figure 4:

**Figure 4. Handset Taxation Approaches**




The most prevalent handset taxation model around the world is based on value-added tax and, in some cases, low sector discrimination through moderate import duty (see Figure 5).

**Figure 5. Handset Taxation Approaches by Country**

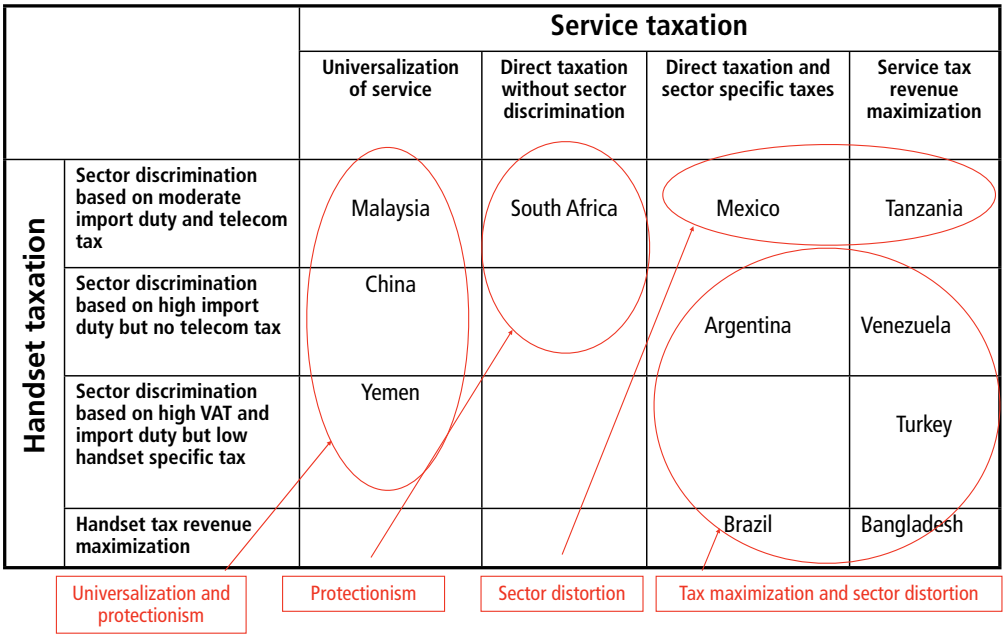
| Continent | Sector discrimination based on moderate import duty | Sector discrimination based on high import duty | Sector discrimination based on high VAT and import duty but low handset specific tax | Handset revenue maximization |
|---|---|---|---|---|
| Africa | Angola, Egypt, Ethiopia, Gabon, Guinea-Bissau, Kenya, Mauritania, Mauritius, Morocco, Seychelles, S. Leone, S. Africa, Swaziland, Tanzania, Uganda, Zambia, Zimbabwe | Cameroon, Chad, DR Congo, Gambia, Guinea, Malawi, rep. Congo, Rwanda | Botswana, Burkina Fasso, Cote d'Ivoire, Madagascar, Mozambique, Senegal, Tunisia | Ghana, Nigeria, Lesotho |
| Middle East | Jordan | | Turkey, Yemen | Syria |
| Asia Pacific | Cambodia, Lao, Malaysia, Myanmar, P. N. Guinea, Pakistan, Philippines, Thailand, Thailand, Vietnam | Bhutan, China, Indonesia, Samoa, Sri Lanka | India, Nepal | Bangladesh |
| Latin America | Bolivia, Chile, Colombia, D. Republic, Ecuador, Guatemala, Nicaragua, Paraguay, Perú, México | Argentina, Trinidad & Tobago, Venezuela | | Brazil |
| Eastern Europe | Albania, Kazakhstan, Russia, Ukraine, Uzbekistan | Azerbaijan, Georgia | | |
| Western Europe | Austria, Bulgaria, Cyprus, Czech Rep., Denmark, Estonia, France, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK | | | Greece |

The combination of service and handset taxation approaches yields four taxation approaches:

- **Universalization and protectionism:** this approach aims at reducing levies with the purpose of decreasing total cost of ownership and stimulating wireless adoption; it can include a handset import duty and a sector specific handset tax (which is relatively low and therefore has minimum distortion potential)
- **Protectionism:** this approach is similar to the one above, except that high value-added taxes on service increase substantially the total cost of ownership
- **Sector distortion:** this approach introduces sector specific service taxes with the objective of increasing government revenues but, in doing so, plays an economically distortion role by emphasizing taxes on the telecommunications sector
- **Tax maximization and sector distortion:** sector specific taxes are introduced not only on mobile services but also on devices with the purpose of maximizing government revenues, with the consequent distortion impact

These four approaches can be visualized in figure 6.

**Figure 6. Combined taxation approaches**




As pointed out before, prevalent taxation models tend to differ by region. As expected, most developed countries have adopted *universalization and protectionism* tax approaches given that they do not need to rely on the telecommunications industry to increase revenues for the treasury. In addition, there are a number of emerging countries which have chosen a *Universalization and Protectionism* approach in order to stimulate telecommunications service adoption. Notable examples in this category are China, Angola and Malaysia.

In the next category of taxation approach *-protectionism-* several emerging countries that have adopted pro-active ICT development strategies (India, Rwanda, Egypt, Chile and Kazakhstan) can be identified. In other words, the first two taxation categories are associated with technology development objectives.

At the other end of the spectrum there are also some significantly large emerging countries – Mexico, Argentina, Brazil, Venezuela, Nigeria, Bangladesh, Pakistan – where the taxation approach runs counter to maximizing telecommunications adoption. Figure 7 provides the model followed by all countries of the study dataset.

**Figure 7. Combined Taxation Approach by Country**

| Continent | Universalization and protectionism | Protectionism | Sector distortion | Tax maximization and sector distortion |
|---|---|---|---|---|
| Africa | Angola, Botswana, Lesotho, S. Leone, Swaziland | Cameroon, Chad, Cote d'Ivoire, DR Congo, Egypt, Ethiopia, Gabon, Gambia, Guinea, Guinea-Bissau, Madagascar, Mauritania, Mauritius, Morocco, Mozambique, Rwanda, Seychelles, S. Africa, Zimbabwe | Kenya, Tanzania, Uganda, Zambia | Burkina Faso, Ghana, Madagascar, Nigeria, Senegal, Tunisia |
| Middle East | Syria, Yemen | | Jordan | Iran, Turkey |
| Asia Pacific | Bhutan, China, , Indonesia, Lao, Malaysia, Myanmar, P. New Guinea, Thailand, Vietnam | India, Philippines, Samoa | Cambodia | Bangladesh, Nepal, Pakistan, Sri Lanka |
| Latin America | Paraguay | Bolivia, Chile, Guatemala, Nicaragua, Perú, Trinidad & Tobago | Dominican Rep., Ecuador, Mexico, Colombia | Argentina, Brazil, Venezuela |
| Eastern Europe | | Azerbaijan, Georgia, Kazakhstan, Russia, Uzbekistan | Albania , Ukraine | |
| Western Europe | Austria, Bulgaria, Cyprus, Czech Rep., Denmark, Estonia, France, Finland, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK | | Greece | |

Based on the taxonomy reviewed above, five countries were selected to analyze the impact of taxation approaches on wireless broadband. Four case studies were conducted on the negative impact of taxes on service adoption:

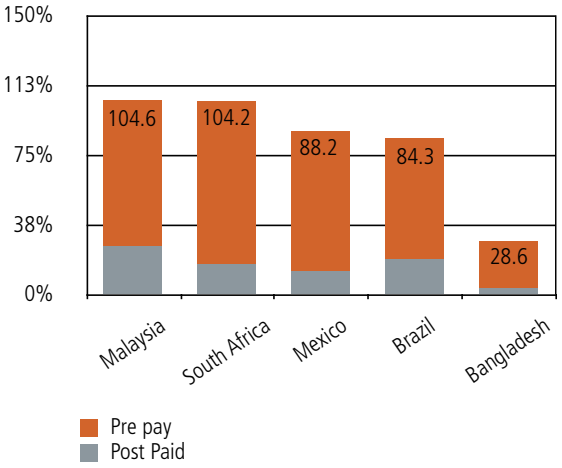
- *Protectionism:* South Africa
- *Sector distortion:* Mexico
- *Tax maximization and sector distortion:* Brazil and Bangladesh

In addition, a country belonging to the *Universalization and Protectionism* type – Malaysia – was also studied.

# 3. Cross-Sectional Analysis Of Taxation Impact On Mobile Broadband

The five countries that are being studied exhibit different levels of mobile penetration. On one hand, Malaysia and South Africa have reached mobile penetration levels in excess of 100%, while Mexico and Brazil are rapidly achieving comparable levels of development. On the other hand, Bangladesh, with a mobile penetration of 29 %, is significantly lagging behind the other countries (see Figure 8).

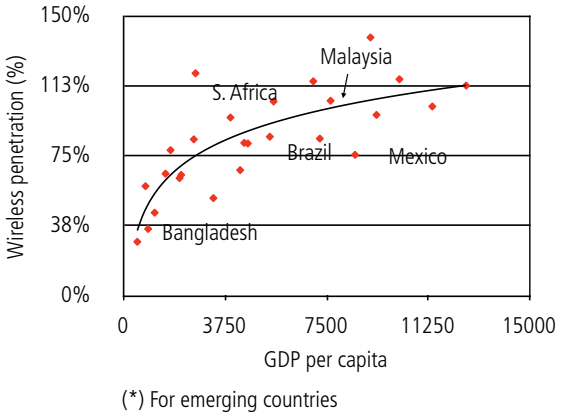
**Figure 8. Mobile Penetration ( 2Q2009)**




Sources: ITU; Wireless Intelligence; Merrill Lynch; World Bank; TAS analysis

When related to the level of economic development, Bangladesh, Brazil and Mexico have a wireless penetration lagging the size of their economy (see Figure 9).

**Figure 9. Mobile Subscribers and Economic Development within Emerging Countries (2009)**




Sources: ITU; Wireless Intelligence; Merrill Lynch; World Bank; TAS analysis

All five countries lag significantly in terms of their fixed broadband penetration. Consistent with the levels of broadband adoption in the emerging world, fixed broadband in all five countries is underdeveloped. The highest penetrated country is Mexico (7.05% of population, 28.31 % of households), followed by Malaysia (4.78 % of population, 23.00 % of households), Brazil (5.20 % of population, 18.88 % of households), South Africa (0.80 % of population, 2.82 % of households) and Bangladesh (0.03 % of population, 0.16 % of households). These statistics indicate the wide gap existing between the developed and emerging world (see Figure 10).

**Figure 10. Comparative Broadband Penetration**

| Continent/Country | Population Penetration |
|---|---|
| Western Europe | 25.0 % |
| North America | 28.0 % |
| Asia | 6.0 % |
| Latin America | 5.5 % |
| Africa and Middle East | 1.0 % |
| Mexico | 7.05 % |
| Malaysia | 4.78 % |
| Brazil | 5.20 % |
| South Africa | 0.80 % |
| Bangladesh | 0.03 % |

Sources: ITU; Euromonitor; World Bank; TAS analysis

Cognizant of this wide disparity, the governments in all five countries studied are in the course of implementing public policies aimed at stimulating broadband deployment and adoption. In Malaysia, the country with the most aggressive program, the government objective is to reach 50% penetration by the end of 2010. Wireless broadband is the technology of choice to achieve this target. For this purpose, the government has issued new spectrum licenses to four companies that will roll out new wireless broadband services based on Wimax platforms. Furthermore, to rationalize capital investment, the government has imposed sharing agreements for towers among HSDPA and Wimax operators. Finally, as an incentive for operators to roll out their broadband networks, the government also approved tax allowances on expenditures on last-mile broadband equipment.

In South Africa, the broadband policy is less aggressive in terms of investment promotion than in Malaysia. In this case, the government has created a state-owned broadband company to provide backhaul services to last mile service providers.

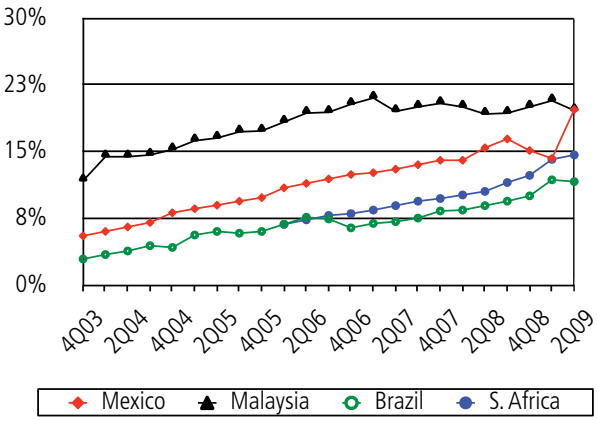
In Mexico, the government aims to achieve 22% broadband population penetration by 2012. The primary policy vehicle is the promotion of platform-based competition, where explicit and implicit policies have benefited cable providers, while restricting the fixed line incumbent (Telmex) from providing triple play. In addition, the government has auctioned national fiber optic infrastructure to create an alternative backbone dealing with specific market bottlenecks.

In Brazil, the government is considering, under the National Broadband Plan, a geographically segmented approach. In developed areas, it is planning to leverage platform-based competition in order to stimulate deployment of next generation networks capable of delivering download speeds of up 100 Mbps. At the same time, the government is planning to implement the necessary policy tools to stimulate deployment of low cost wireless broadband services by private carriers in isolated areas. Finally, the national policy considers funding the deployment of micro-telcos interconnected with the national backbone through a government-owned network that leverages the fiber optic capacity of electric and oil utilities.

In Bangladesh, the government aims to provide internet facilities to 30 percent of the population and community-based broadband to all villages by 2015. In order to achieve this target, spectrum licenses were auctioned to offer fixed WiMax service in 2008, while 3G licenses will be put up for bid in 2010. In parallel, the government is promoting the sharing of infrastructure (backbone, towers) to reduce capital deployment costs.

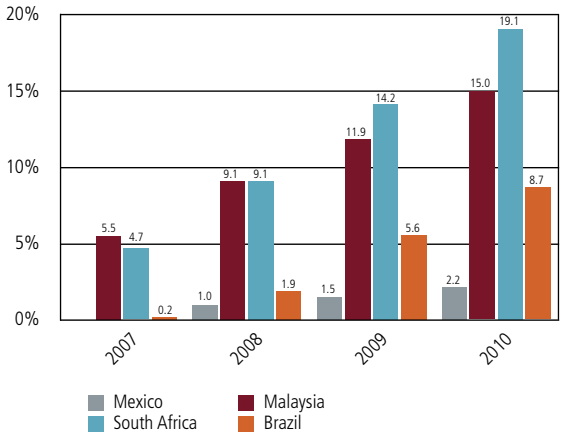
In general terms, all five countries envision mobile broadband as a key lever to address the digital inclusion gap. With the exception of Bangladesh, where 3G licenses have not been auctioned yet – though the process is expected to begin soon – all countries register a continuous increase in wireless broadband services combined with the deployment of 3G enabled handsets and devices (see Figures 11 and 12).

**Figure 11. Mobile data as a percentage of service revenues (2003-9)**




Source: Merrill Lynch; TAS analysis

**Figure 12. 3G Phone subscribers as a percentage of all subscribers (2007-2010)**




Source: BMI; TAS analysis

In this context, taxation on mobile services and devices could have a detrimental effect on the public policy strategy aimed at deploying broadband. This is particularly the case of four of the five countries under study. With the exception of Malaysia, which has implemented a benign taxation system based on extremely low value-added tax, the other countries have introduced taxes that could negatively affect service diffusion, as would be the cases of Brazil and Bangladesh (see Figure 13).

**Figure 13. Mobile Taxation approaches in the five countries under study**

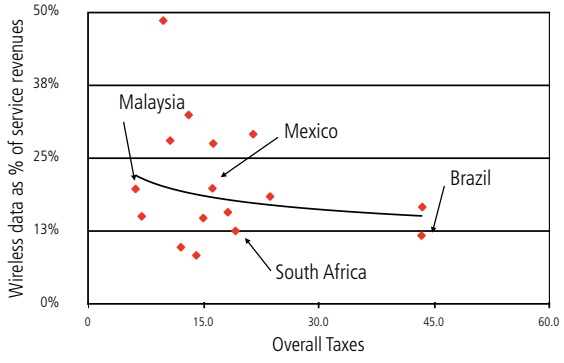
| Country | Services | | | Handset | | | | Taxation Approach |
|---|---|---|---|---|---|---|---|---|
| | VAT | Other Taxes | Fixed Taxes | VAT | Customs Duty | Other Taxes | Fixed Taxes | |
| Malaysia | 5% | - - - | - - - | 10% | - - - | - - - | - - - | Universalization and protectionism |
| South Africa | 14% | - - - | - - - | 14% | 7.60% | - - - | - - - | Protectionism |
| Mexico | 16% | 3% (*) | - - - | 16% | 0.10% | - - - | - - - | Sector distortion |
| Brazil | 33% | 5.1% | - - - | 33% | 19% | 9.30% | $13.35 | Tax maximization and sector distortion |
| Bangladesh | 15% | 35% | $11.76 | 15% | 12% | - - - | $11.63 | |

(*) Applies to all telecommunications services except for fixed and mobile broadband
Source: Deloitte (2008); updated by TAS

The impact of these different taxation approaches on total cost of ownership of mobile service varies widely. For example, in Mexico the impact of taxes on total cost of ownership is 18.4%[10], in South Africa it is 14.9%, in Brazil it reaches 43.3 %, while in Bangladesh it is 54.8%. On the other hand, in Malaysia, the effect of taxes on mobile cost of ownership amounts to only 6.1%.

Taxation of mobile services appears to have an impact on the deployment of mobile broadband. For example, *ceteris paribus*, there may be some association between the very high level of taxes in Brazil and its very low penetration level of 3G handsets. On the other hand, Malaysia shows a low level of taxes and a higher 3G penetration rate. Similarly, an inverse relationship appears to exist between tax burden and adoption of data services when measured by wireless data as percent of service revenues (see Figure 14).

**Figure 14. Taxation vs. Adoption of Data Services**




Source: Deloitte (2008); Merrill Lynch; TAS analysis

If taxes limit adoption of wireless broadband, it is pertinent to ask what the ultimate impact of reduced penetration might have on economic growth. This will be analyzed in section 5 of the study.

To conclude, it is safe to assume that a reduction in adoption as a result of incremental taxation (as discussed in section 3) could yield a negative impact on GDP growth. This fundamental statement will be tested through five detailed country case studies – two with high taxation (Brazil and Bangladesh), two with moderate levels of levies (Mexico and South Africa) and one low (Malaysia). The analysis will proceed from examining the country taxation on telecommunications services (in section 4) to the estimation of the economic impact (in section 5).

[10] In the case of mobile broadband in Mexico the impact of taxes on total cost of ownership is 16.1% since some levies do not apply

# 4. Case Studies On Mobile Broadband Taxation

## 4.1. Mexico

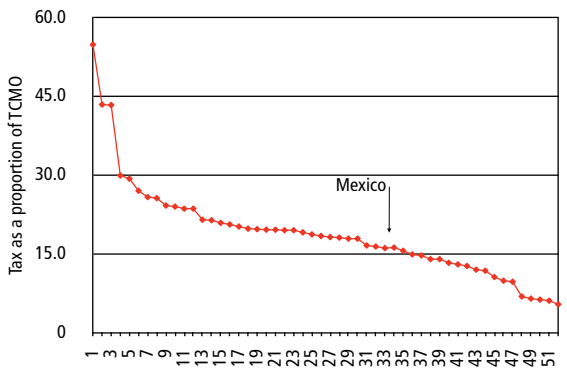
Telecommunications service taxes in Mexico have been politically charged for several decades. Before privatization, taxes were well above 50%, as Telmex, the state-owned monopoly, was used as a cash-cow for the government. Since market liberalization, operators were also taxed with additional levies (e.g. use of spectrum, licensing, universal service fund, etc.), while services were charged a regular value added tax, which went from 10% to 15%, then back to 10% and then 15% until 2009. It was increased to 16% as of 2010.

In 1998, a special telecommunications tax was discussed (and approved); mobile services were charged a "luxury tax" (6%), which was later decided it only applied to certain post-paid wireless price plans. Operators were able to legally circumvent the tax through marketing manoeuvres and it was abolished in 2002.

In 2009, a new debate on telecommunications taxes was initiated. A special tax of 3% (the original proposal was 4%) was imposed on all telecommunications services except broadband. As the law is not clear on how it applies to (a) mobile broadband and (b) bundles (e.g., triple play), it is becoming again an arbitrage opportunity and will probably continue to be discussed.

Based on the multiple levies, the percentage of taxes in the overall cost of mobile broadband ownership is somewhat lower than the average in developing countries: 16.1% (see Figure 15).

**Figure 15. Overall Total Cost of Ownership of Mobile Services in Developing Countries**

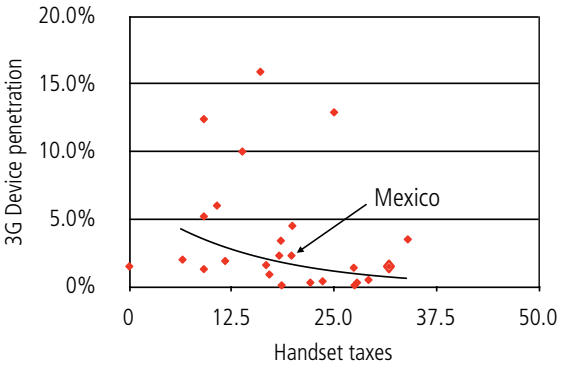



Note: The horizontal axis depicts the distribution of tax as a percentage of Total Cost of ownership in 52 countries that have been analyzed.

Sources: Deloitte (2008); updated by TAS

However, the Mexican taxation approach remains relatively high, which constitutes a barrier for 3G adoption (see Figure 16).

**Figure 16.Handset Taxes and 3G Device Penetration**




Sources: Merrill Lynch; Deloitte (2008) updated by TAS; TAS analysis

As figure 16 indicates, with handset taxes being high in comparison to other emerging markets, the penetration of 3G devices, which should be considered an enabler of mobile broadband, is low.

## 4.2. Malaysia

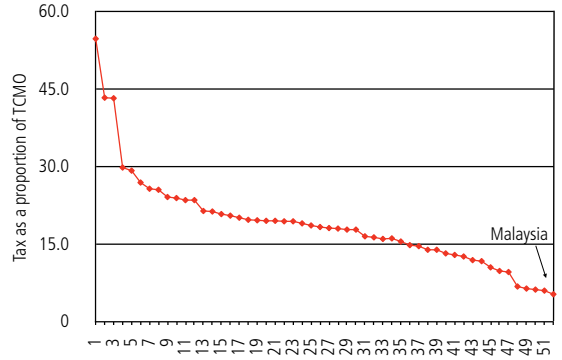
Malaysia's taxation model of mobile services follows the "*universalization and protectionism*" approach. A general consumption tax, VAT at 5%, is levied on usage (price per minute) and 10% on handsets/devices. Handheld products such as Personal Digital Assistants are exempt from sales tax and there are no mobile specific taxes or import duties.

Since 1996 there have been no import duties or sales tax on software, computers and components (except telecommunications equipment). Tariff duties for such goods will vary based on the equipment type. Removal of customs duties on broadcasting and post-production equipment is also an indication of the government's commitment to stimulate the growth of the IT industry, particularly the development of multimedia applications.

Under its 2008 budget, the Ministry of Finance approved, as an incentive for operators to roll out their BBGP networks, tax allowances on expenditures for last-mile broadband equipment. Among them, last mile network facilities providers

will be given investment allowance of 100 % on capital expenditures incurred for broadband up to 31 December 2010. This approach to taxation reflects a government policy aimed at promoting broadband adoption throughout the economy. Government charges only 6.1% of total cost, mostly through VAT, thus the impact on total cost of ownership is low (see Figure 17).

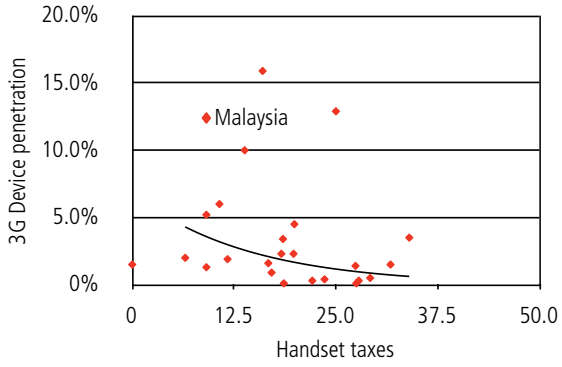
**Figure 17. Overall Total Cost of Ownership of Mobile Services in Developing Countries**




Sources: Deloitte (2008); updated by TAS

As a result of the low tax profile, Malaysia exhibits high penetration of 3G enabled handsets (see Figure 18).

**Figure 18. 3G Penetration Vs. Handset Taxes**




Sources: Merrill Lynch; Deloitte (2008) updated by TAS; TAS analysis

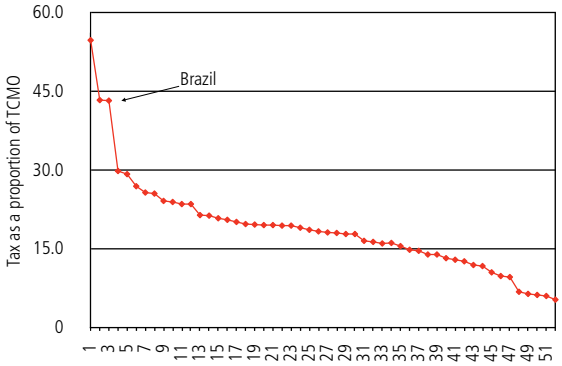
## 4.3. Brazil

The mobile taxation system in Brazil is extremely complex and unusually high. Our estimates indicate that of every unit of local currency that a consumer pays for telecommunications services, about 0.65 goes to the government (in a myriad of taxes). The basic structure comprises an internal VAT (ICMS), which is calculated over revenues and is set by the states. It ranges from 18% to 35%, and thus, is equivalent to 22% to 54% of an internationally understood VAT[11].

Additionally, other contributions exist: PIS and Cofins, at the rates of 0.65% and 3%, a universal service contribution (1%), and a contribution to a technological development fund (0.5%). Another tax, Fistel, is mainly used to pay for Anatel's (regulator) running costs; its main contribution comes from a payment by the mobile operators of R$26.84 (USD 15.00) for each new line that is activated and R$13.42 per line in service on a yearly basis. Most of these taxes also apply to handsets, though certain types of handsets are also subject to import duties. Except for the VAT and the universal service tax, all of these levies work in cascade mode, meaning they are paid on every transaction (this, for example, is relevant on interconnection payments).

Total tax impact on TCO then, is estimated at 43.3%. Services are taxed at 40.2% and handsets at an average of 57.3%, assuming 30% of handsets are imported.

**Figure 19. Overall Total Cost of Ownership of Mobile Services in Developing Countries**

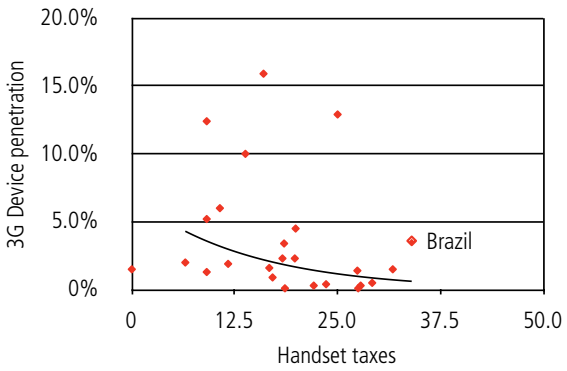



Sources: Deloitte (2008); updated by TAS

This tax system is delaying the spread of 3G technology among Brazilian consumers (see Figure 20).

[11] Note: calculation is the following: 18/ (100-18) or 35/ (100-35).

**Figure 20. 3G Penetration Vs. Handset Taxes**




Sources: Merrill Lynch; Deloitte (2009) updated by TAS; TAS analysis

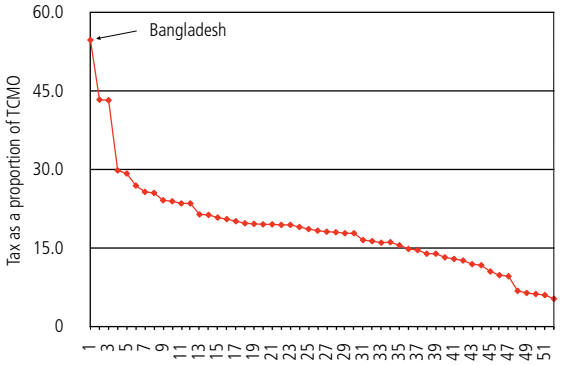
Telecommunications taxation has been part of the national debate since the privatization of Telebras back in 1998, but the government has been unwilling to relinquish the taxes collected from the sector. Recently, Oi, a national carrier present in the fixed and mobile segments, suggested reducing taxes as part of the government's contribution to the implementation of its National Broadband Plan, which contemplates the heavy use of public funds.

## 4.4. Bangladesh

The Bangladesh mobile industry has two types of taxes. The first is a general consumption tax of 15 % that is levied on the price per minute paid and on subscription and connection costs. The second is a mobile specific tax on SIM cards and an import tax on handsets. The Bangladeshi government taxes all new handsets that are imported to the country at a flat rate of Taka 300 (approximately US$4.30 or 12% of price).

The VAT rate at 15% has been in place since the mid-1990s. The main changes in the taxation of mobile services have been to the mobile-specific taxes. In its 2005-06 budget the Bangladesh government imposed a Taka 900 tax on each SIM that was issued. Prior to this, connection charges, which included the cost of a new SIM card, were taxed at the standard variable rate of 15%. Grameenphone paid US$63.55 million corporate tax in 2007-08 fiscal years and became the highest contributor in this category. Moreover Grameenphone, Banglalink, and TMIB have contributed 23% of the total top ten value-added tax by paying $338 million at the same time. Taxes represent approximately 54.8 % of total cost of ownership (see Figure 21).

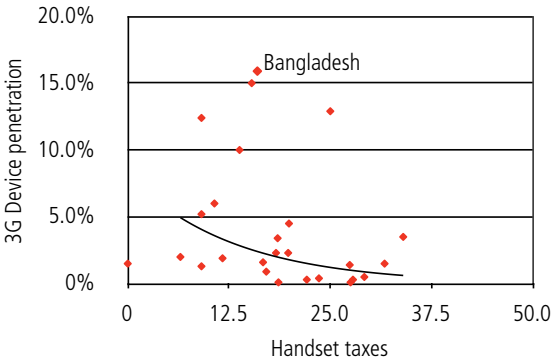
**Figure 21. Overall Total Cost of Mobile Ownership in Developing Countries**




(*) Note: estimated
Sources: Deloitte (2008); updated by TAS

While the tax burden on total cost of ownership does not appear to be a barrier for future 3G adoption, it remains to be seen what the future impact of mobile broadband might be (see Figure 22).

**Figure 22. 3G Penetration versus handset taxes**

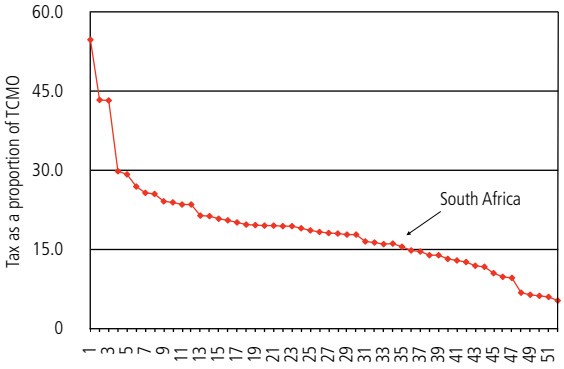



Sources: Merrill Lynch; Deloitte (2008) updated by TAS; TAS analysis

## 4.5. South Africa

The South African government charges a value-added tax of 14 % with no sector discrimination. There are no fixed taxes for telecommunication services. However, handsets face both the VAT of 14 % as well as a rather moderate import duty rate of 7.6 %. It thus falls in the category of a protectionist tax system that increases the total cost of services for final consumers but with no sector discrimination in mobile services (see Figure 23).

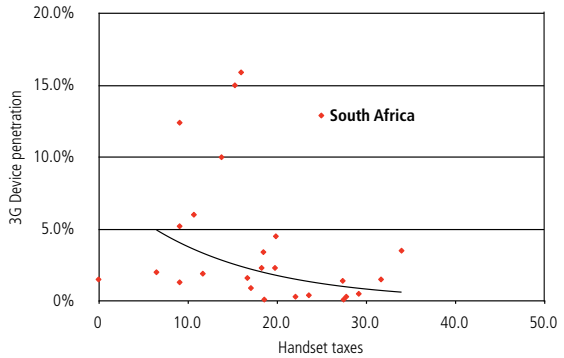
**Figure 23. Overall Total Cost of Ownership of Mobile Services**




Sources: Deloitte (2008); updated by TAS

Again, while this tax on handsets might not seem to be a barrier for future 3G adoption, it remains to be seen what the net comparative impact will be on mobile broadband services (See Figure 24).

**Figure 24. 3G Penetration versus handset taxes**




Sources: Merrill Lynch; Deloitte (2009) updated by TAS; TAS analysis

# 5. Quantitative Assessment Of Impact Of Taxation On Mobile Broadband And The Economy

## 5.1. Theoretical Framework:

Without a doubt, telecommunications is one of the most dynamic industries in the world, with a significant contribution to gross domestic product and general economic welfare, not only through its direct impact but also by means of important positive externalities throughout the economy. Spillover effects have a measurable impact on growth, which, compounded throughout time, can make a significant difference in overall wealth indicators. As such, from a purely theoretical perspective, telecommunications services belong to a category which must be considered as a potential target of goods and services that could be promoted by the state by reducing its tax burden on adoption. In practice, though, the opposite is observed. Taxing telecommunications services is simple because a significant part of the effort of collecting revenues is executed on a handful of very large formal corporations. Thus, taxing telecommunications firms provides an easy way of generating revenue in an efficient manner. However, it is inconsistent with the utmost goal of governments, which is to maximize the conditions to generate economic and social welfare.

As a general principle, telecommunications services have negative elasticities: higher prices imply lower demand. Thus, taxes on telecommunications services automatically have an impact on overall demand, penetration, and usage. Taxes on handsets and other devices have a different impact on demand as would a tax levied on the service itself. The first has an impact not only on adoption (ie, penetration), with its well understood negative consequences, but also on the upgrading of equipment, which in turn has negative effects on the spread and adoption of new services and better quality. The latter has an impact on usage, not only by deterring penetration, but also reducing the potential of economic spillovers which arise from more time of use and more data transferred.

For simplicity reasons, and due to the lack of reliable estimates of segmented elasticities, the impact on the economy of taxes levied on mobile broadband is estimated through the use of the concept of "total cost of ownership" (TCO), which is a proxy on how much it costs to own and use a mobile line. TCO is the sum of the cost of usage (service) plus part of the cost of the handset, which is assumed to be amortized throughout its lifetime, usually between two and three years[12]. Taxation, thus, impacts TCO negatively but differently depending on its structure and the pattern of replacement.

The first order effects of taxation are obvious: lower penetration and less frequent use. Usually, lower penetration reflects not on a reduction of the actual penetration but on a decrease of the growth rate. This is crucial in understanding why, after an increase in tax rates applied to telecommunications services, total tax revenues increase. Additionally, given that prepaid is the most common mode of mobile usage, with a minimal or zero ongoing charge needed to keep the line in service, coupled with the widespread practice of CPP (calling party pays) schemes, people are reticent to drop their line, especially as there is a sunk cost (ie, the acquisition of the line) that has already been incurred. In other words, in general terms, mobile taxes deter growth but do not translate into short term decreases in penetration.

As for usage, higher taxes have the expected result of lowering usage, as it is a recurring event. Consumers make a buying decision every time they use their device, and thus, rapidly adjust their pattern of consumption depending on the new price.

Lower future penetrations and lower usage have an impact on lower economic spillover. Lower economic spillover is captured in the difference of expected growth as measured by the estimates of elasticity described in Section 5.2 below.

Though the previous analysis renders an explanation and estimate of the negative effects of taxation on penetration, usage, and economic growth, it does not provide a complete picture, as it does not look at the other side of the coin. Taxation per se is not a destruction of wealth or economic welfare. Taxation implies the transfer of resources from one hand (consumers) to another (government). The impact described above is what these resources could generate to the economy if they were to remain in the hands of consumers. What needs to be answered is whether these resources can be put to a better use if they were in the hands of government.

[12] Until the economic crisis, average replacement cycle for handsets was 18 months. This has been found to increase since then.

The main purpose of taxation is to generate revenue to finance public sector activities that deliver their policy objectives, including, but not limited to, increasing the rate of economic growth. However, taxes may impose economic costs, the so called "deadweight losses" or distortion costs. Taxes are a means of transferring resources from private to public use and economic costs are incurred when the amount of resources available for society's use, whether for public or private purposes, is reduced by taxes. That is, real economic costs are incurred when the difference between the decrease in private sector resources per unit and the increase in the net revenue of the government is negative. Countries need to adopt tax policies to help ensure that those resources are used as efficiently as possible so as to minimize deadweight losses that may lower their overall national output. In other words, if governments can create more wealth than private users from a marginal unit, the amount of taxes collected from a sector that has significant positive externalities will result in a larger overall national input. That is, taxation would be positive for the general welfare of the population.

This chapter attempts to estimate the value of money if it were to remain in the hands of the population in the form of lower overall prices for mobile broadband services. As will be shown, the return on this capital is significant, increasing ten-fold in certain cases after a period of only 5 years. Moreover, the impact on total tax revenue collected is estimated. As lower tax rates are applied to all the existing and new customers, a significant percentage of tax revenue is foregone. These foregone revenues are partially or totally compensated by two facts. First, as lower taxes reflect on higher growth rates for the services, the total tax base will be larger. Secondly, higher penetration reflects on additional GDP. It is sensible to assume that this additional GDP will be taxed. For lack of better estimates, it will be considered that this additional GDP will be taxed at the average rate applied to the whole economy, as measured by tax revenues as a percentage of GDP.

The question is then if governments that impose distortive taxes to the telecommunications sector are capable of allocating this capital to a better use and create with it more wealth than if the capital were to remain in the hands of consumers. To measure welfare were the capital to remain in the hands of consumers, this analysis looks at the ratio of additional GDP created per additional tax unit collected. This provides the benchmark to which countries ought to compare the effectiveness of their marginal public expenditure.

## 5.2. Economic impact of broadband

Broadband technology has been found to be a contributor to economic growth at several levels. First, the deployment of broadband technology across business enterprises contributes to the improvement of productivity resulting from the adoption of more efficient business processes (e.g., marketing of excess inventories, optimization of supply chains). Second, extensive deployment of broadband across the population contributes to the acceleration of innovation resulting from the introduction of new applications and services (e.g., new forms of commerce and financial intermediation). Third, broadband leads to a more efficient functional deployment of enterprises by maximizing their reach to labor pools or access to raw materials or consumers (e.g., outsourcing of services, virtual call centers).

These effects have been measured in the aggregate in numerous studies. Katz et al. (2010) conducted a study measuring the impact of broadband on the economic growth of Germany between 2003 and 2006. By relying on disaggregated county-level panel data of population growth, broadband penetration, and GDP per capita for the year 2000 for control purposes, the authors found that an incremental penetration of broadband of 1% yields 0.026% incremental growth in GDP. This result is fairly consistent with Koutrompis (2009) simultaneous equation-based analysis of 22 OECD countries, which found that an increase in broadband penetration of 1% yields 0.025% increase in economic growth. In a recent study of 24 countries in Latin America and the Caribbean, Katz (2010) estimated that when controlling for educational level and starting point of development, 1% increase in broadband penetration yields 0.017 point contribution to GDP growth[13]. Finally, the World Bank in a recent study (Qiang, 2009) indicated that for high income economies, every 1 percentage point of broadband penetration yielded an additional 0.121 percentage points of GDP growth, while for low and middle income economies, 1 percentage point of broadband penetration yielded an additional 0.138 in economic growth. While the range of these estimates varies, the conclusion is always the same: broadband penetration increases GDP growth.

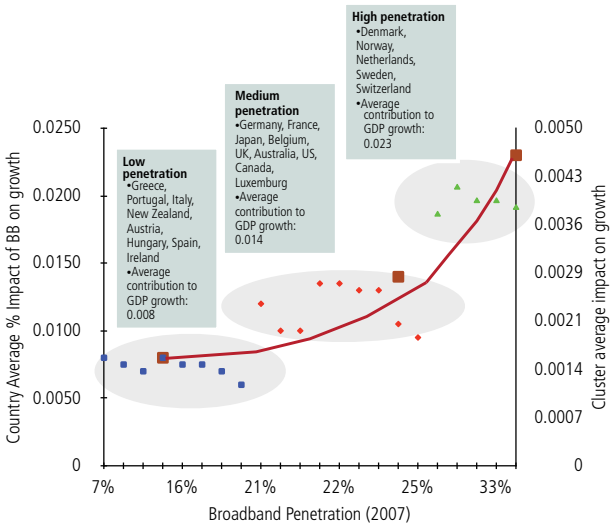
[13] Results included in appendix E.

In addition to measuring impact on economic growth, several studies have also estimated the effect of broadband deployment on employment creation. By relying on regional disaggregated data for Chile between the years 2000 and 2009, Katz (2010) found that, when controlling for regional economic differences, an increase in broadband penetration of 1% yields an increase in 0.18% in the occupation rate. Similarly, Lehr et al. (2005) analyzed US level data disaggregated at the postal code level and found that broadband availability at a community level added over 1% to employment growth. Shideler et al. (2007) conducted a similar study relying on disaggregated county data for the state of Kentucky and found that an increase in broadband penetration of 1% contributes to total employment ranging from 0.14% to 5.32% depending on the industry sector.

In addition to confirming the aggregate economic impact, recent research has begun to establish that the effect of broadband grows with the level of penetration. Katz et al. (2010) have determined that the economic impact of broadband is stronger in those regions reaching higher levels of penetration. By dividing Germany in counties with high penetration of broadband (>34%) and low penetration (<34%), they observed that 1% increase in broadband penetration yielded 0.0238 percentage points increase to GDP in lesser advanced areas and 0.0256 in more broadband penetrated areas. This would validate the notion that, with network effects, the multiplier impact of broadband grows with penetration. These estimates are consistent with growing evidence of the "critical mass" theory of broadband economic impact. Koutroumpis (2009) found that for OECD countries, the contribution of broadband to economic growth increased with penetration (see figure 25).

The implications of the concept of "critical mass" in estimating broadband economic impact are fundamental. A decrease in the growth rate of broadband penetration resulting from taxation impact on TCO will reduce the broadband contribution to economic growth.

**Figure 25. OECD: Percentage of Impact of Broadband on GDP Growth**




Source: adapted from Koutroumpis (2009)

## 5.3. Economic impact of taxation on mobile broadband

To quantify the impact of taxes on economic growth, this report produced two estimates based on the approach described above. Firstly, for each country, the impact of 1 percentage point decrease in the level of taxes currently practiced was estimated. Secondly, we estimated the impact if taxes were reduced to the 6.1% of TCO, which is the level practiced in Malaysia and which we are taking as the benchmark case.

Numbers are reported in tables, with the bounds for penetration elasticity ranging from 0.6 to 1.2, and GDP elasticity at three levels: 0.17 (as explained above), 0.6 (Waverman et al, 2005), and 1.38 (Qiang et al., 2009).

The first table in each case is the estimate of total GDP contribution, in dollars, to the economy over a 5 year period (2010-2014). The second table estimates the impact of tax collection, assumed to be direct tax revenue foregone by applying a lower tax rate, compensated by a larger base, and the average tax collection as a percentage of additional GDP. The accumulated return, shown on the third table, was estimated as the additional GDP created over 5 years divided by the total direct foregone revenues. This number is a proxy of the spillover effects that would

need to be created by those tax dollars that were foregone by lowering the tax rate if they were to be spent by the government, either as current spending, investment, or wealth redistribution. It represents the return required for a neutral wealth creation scenario. In several cases, as reducing taxes translates into higher tax revenue, this number becomes negative. While it might be counterintuitive, lower taxes on mobile broadband services means that the growth on externalities more than compensates for the decrease in the tax rate.

The last three tables in each case correspond to the estimate of effects in the hypothetical case of reducing taxes to the level currently applied in Malaysia (6.1% on TCO). Even though it is a drastic scenario compared to current levels applied in Mexico, South Africa, Brazil, and Bangladesh, the results demonstrate the magnitude of the effect that a more beneficial tax system would have on the economy. This is probably one of the reasons why countries such as Malaysia have managed to consistently outperform, in this and other indices, the development of other large developing economies.

### 5.3.1. Mexico

Current taxes on TCO are 16.1%. By reducing taxes to 15.1%, in effect, bringing them to the rate that was applied until 2009, would have an impact of 0.3 to 0.5 p.p. of additional mobile penetration after 5 years. This implies 0.3 to 0.6 million additional users, equivalent to a base which would be 3-5% higher. The overall accumulated effect over the same period on GDP would range from US$600 MM to US$2.4 billion (see Figure 26). Collected taxes would go from a total foregone revenue of US$35 MM to an additional amount of US$155 (see Figure 27); that is, not only would consumers be paying lower taxes but the government would be collecting more revenues than if the tax remained at the current level.

**Figure 26: Accumulated additional GDP (in US$ billion)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | **0.17 %** | **0.60 %** | **1.38 %** |
| **Penetration elasticity** | 0.6 | $ 0.6 | $ 0.5 | $ 1.2 |
| | 1.2 | $ 0.8 | $ 1.0 | $ 2.4 |

**Figure 27: Impact on tax revenue (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | **0.17 %** | **0.60 %** | **1.38 %** |
| **Penetration elasticity** | 0.6 | $ (35) | $ (42) | $ 20 |
| | 1.2 | $ 5 | $ 31 | $ 155 |

**Figure 28: Accumulated return required on each tax dollar for wealth creation neutrality**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | **0.17 %** | **0.60 %** | **1.38 %** |
| **Penetration elasticity** | 0.6 | $ 6.7 | $ 5.9 | $ 13.6 |
| | 1.2 | $ 12.1 | $ 16.4 | $ 37.7 |

Mexico has, year after year, proven to be an inefficient tax collector. Overall taxes represent 19% of GDP, which is low by international standards. Nevertheless, this number hides the fact that the Mexican government still depends heavily on oil-related taxes. Non-oil taxes – income, VAT, and others – represent only 9% of GDP (World Heritage Foundation, 2010), even though marginal tax rates, at 30% are comparable to world practices. Even given this fact, the overall impact on GDP is of such magnitude, that tax losses are quickly offset by taxes collected from a larger user base and the estimated economic spillover.

These effects are even more noteworthy were Mexico to apply a tax of 6.1%, similar to that in Malaysia. On the most extreme estimate of GDP elasticity, an additional US$ 27.9 billion dollars of collective wealth would be created (see Figure 29). This is about $45 per inhabitant per year, an impressive number if we consider that 20% of people still live under extreme poverty conditions. To that estimate corresponds an amount of US$1.7 billion of additional taxes when compared to the current level (see Figure 30).

**Figure 29: Accumulated additional GDP (in US$ billion): From 16.1% to 6.1%**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | **0.17 %** | **0.60 %** | **1.38 %** |
| **Penetration elasticity** | 0.6 | $ 5.9 | $ 5.6 | $ 12.9 |
| | 1.2 | $ 7.8 | $ 12.1 | $ 27.9 |

**Figure 30: Impact on tax revenue: From 16.1% to 6.1% (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ (384) | $ (414) | $ 242 |
| | 1.2 | $ (111) | $ (280) | $ 1,701 |

**Figure 31: Accumulated return required on each tax dollar for wealth creation neutrality: From 16.1% to 6.1%**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 6.5 | $ 6.1 | $ 14.0 |
| | 1.2 | $ 9.6 | $ 15.0 | $ 34.5 |

### 5.3.2. Malaysia

Current taxes on TCO are 6.1%, low by international standards. By reducing taxes by 1 p.p. to 5.1%, penetration would increase additional 0.9 to 1.8 p.p., which implies 0.26 to 0.53 million additional users, equivalent to a base which would be 2.9-5.8% higher. The overall accumulated effect over the same period on GDP would range from US$105 MM to US$1.4 billion (see Figure 32). Collected taxes would go from a total foregone revenue of US$48 MM to an additional amount of US$156 million; as in the Mexico case, lower tax rates most likely imply higher tax revenues (see Figure 33).

**Figure 32: Accumulated additional GDP (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 105 | $ 310 | $ 712 |
| | 1.2 | $ 138 | $ 624 | $ 1,437 |

**Figure 33: Impact on tax revenue (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ (48) | $ (17) | $ 42 |
| | 1.2 | $ (36) | $ 36 | $ 156 |

**Figure 34: Accumulated return required on each tax dollar for wealth creation neutrality**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 1.7 | $ 4.9 | $ 11.3 |
| | 1.2 | $ 2.5 | $ 11.1 | $ 25.6 |

### 5.3.3. Brazil

Not only has Brazil one of the highest tax rates in the world, but also one of the most complex structures. Current taxes on TCO are 43.3%, without considering other levies (universal service fund and development fund contribution). It would then be expected that the impact of small reductions on the total tax rate would be significant; this is confirmed by the economic impact model. Penetration would be 0.3-0.5 p.p. higher, equivalent to 520,000-1,050,000 additional users; this is a subscriber base 2.1%-4.2% higher than would be expected with the current tax rate. As small as these numbers appear, the accumulated impact on total wealth created ranges from US$0.72 to US$3.37 billion (see Figure 35). No taxes are foregone in any scenario (see Figure 36), which means that tax revenue increases, there is more wealth created overall, and about a million more Brazilians will be connected through mobile broadband devices.

**Figure 35: Accumulated additional GDP (in US$ billion)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 0.7 | $ 0.5 | $ 1.7 |
| | 1.2 | $ 0.9 | $ 1.5 | $ 3.4 |

**Figure 36: Impact on tax revenue (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 115 | $ 117 | $ 485 |
| | 1.2 | $ 329 | $ 532 | $ 1,272 |

**Figure 37: Accumulated return required on each tax dollar for wealth creation neutrality**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 4.4 | $ 4.4 | $ 10.1 |
| | 1.2 | $ 25.6 | $ 39.7 | $ 91.4 |

It is unlikely that the Brazilian government be willing to adopt a beneficial tax rate to telecommunications similar to that of Malaysia. It is illustrative, though, given the size of the economy and the current tax rate applied, to see what the impact of such a measure would be in the economy as a whole. Wealth creation would be a non-negligible amount of anywhere from $27 to $205 billion over 5 years, an amount equivalent to more than $200 per person per year (see Figure 38). In all cases, tax collections would increase. As the returns on such an action are so significant – up to $73 for each foregone tax dollar – it is hard to believe that any marginal action currently undertaken by Brazil to spend this tax income will be able to produce more wealth to the economy.

**Figure 38: Accumulated additional GDP (in US$ billion): From 43.3% to 6.1%**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 27.3 | $ 34.7 | $ 80.2 |
| | 1.2 | $ 35.5 | $ 178.2 | $ 205.5 |

**Figure 39: Impact on tax revenue: From 43.3% to 6.1% (negative numbers represent foregone taxes) (in US$ billion)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 2.9 | $ 5.8 | $ 23.4 |
| | 1.2 | $ 7.1 | $ 27.6 | $ 73.1 |

**Figure 40: Accumulated return required on each tax dollar for wealth creation neutrality: From 43.3% to 6.1%**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 3.6 | $ 4.5 | $ 10.5 |
| | 1.2 | $ 5.3 | $ 13.2 | $ 30.8 |

### 5.3.4. Bangladesh

Mobile broadband services have not yet been launched in Bangladesh at the time this report was written. Hence, estimating the impact of lower taxes is difficult; the results are thus only directional. Our model estimates the impact over a five-year period beginning at the launch of 3G services, at any point in time in the future, assuming macroeconomic indicators at the current level. We believe these indicators will be better as of the launch time; in that case, the estimated impact of broadband in the economy will be higher. Penetration of 3G services was assumed to increase at rates similar to other developing economies.

After a five-year period, a marginal reduction of the tax rate on TCO, from 54.8% to 53.8% would increase penetration 0.1-0.2 percentage points. The subscriber base would be 1.9%-3.9% higher, equivalent to 137,000-277,000 additional subscribers. Overall accumulated impact on GDP is low, reflecting the initial stages of broadband and the size of the economy of Bangladesh. The most conservative estimate renders a positive of impact of US$11.4 million, but it could be as high as US$ 52.8 million (see Figure 41). The conservative estimates indicate that there would be a net loss in tax revenue, somewhere around US$21 million (see Figure 42), but the more aggressive scenarios indicate that total tax revenues would actually be higher than with the current level of taxes.

Overall return of these foregone tax dollars is high, but much smaller than in the rest of the cases studied on this report. This is explained by the small size of mobile broadband in its early stages. These effects would grow in a cumulative manner through time, so even small differences in penetration and the adoption rates caused by taxation will have a large and enduring effect on wealth in the medium term.

**Figure 41: Accumulated additional GDP (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ N/A[14] | $ 11.4 | $ 26.2 |
| | 1.2 | $ N/A | $ 22.9 | $ 52.8 |

[14] The methodology used to estimate the impact on GDP of broadband developed for this study assumes the existence of a customer base of reasonable size. Growth in the initial stages (sometimes well above 500%) falls beyond the range for which the parameter we estimated has any applicability.

**Figure 42: Impact on tax revenue (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ N/A | $ (21.1) | $ (19.9) |
| | 1.2 | $ N/A | $ 2.4 | $ 4.9 |

**Figure 43: Accumulated return required on each tax dollar for wealth creation neutrality**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ N/A | $ 0.5 | $ 1.2 |
| | 1.2 | $ N/A | $ (negative)[15] | $ (negative) |

The hypothetical scenario of assuming taxes could be lowered to the level practiced in Malaysia show a much larger impact. The GDP effect over a five-year period could reach US$ 4.9 billion, which is about 5% of current GDP (see Figure 44). This would come at a cost to the treasury of US$ 0.64 – US$ 1.22 billion in the form of foregone revenues. The expected returns on these foregone revenues, though reasonable, range only from $0.6 to $4.63 (see Figure 46).

**Figure 44: Accumulated additional GDP: From 54.8% to 6.1% (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ N/D | $ 0.8 | $ 1.8 |
| | 1.2 | $ N/D | $ 2.1 | $ 4.9 |

**Figure 45: Impact on tax revenue: From 54.8% to 6.1% (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ N/D | $ (1,220) | $ (1,130) |
| | 1.2 | $ N/D | $ (870) | $ (640) |

**Figure 46: Accumulated return required on each tax dollar for wealth creation neutrality: From 54.8% to 6.1%**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ N/D | $ 0.6 | $ 1.4 |
| | 1.2 | $ N/D | $ 2.0 | $ 4.6 |

As overall impact is positive, Bangladesh authorities ought to consider rationalizing the structure and levels of taxation on mobile broadband in order to boost the adoption of these services. It would help close the gap caused by the late launch of these services. It is rapidly falling behind the rest of the world in this dimension; special actions would need to be taken in order to recover lost time.

### 5.3.5. South Africa

In mobile broadband terms, South Africa is reasonably advanced with a penetration of about 8%. Its tax structure, which for services applies only a standard VAT rate, is conducive to growth in synchrony with the economy. Nevertheless, tax incentives could help foster accelerated growth. A 1 p.p. reduction on TCO, from the current 14.9% to 13.9%, could increase penetration after five years by 0.6 to 1.2 p.p, implying 2.6% to 5.3% additional subscribers. The effect on GDP would be anywhere from US$138 million to US$1.34 billion (see Figure 47). On the conservative side, this would come at a cost to the treasury in foregone taxes of about US$ 37 million, but could potentially produce additional tax revenue of around US$300 million (see Figure 48). Thus, the return on the foregone revenue would be significant, ranging from $1.9 to almost $25 (see Figure 49).

**Figure 47: Accumulated additional GDP (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 138 | $ 289 | $ 666 |
| | 1.2 | $ 180 | $ 583 | $ 1,342 |

[15] The "accumulated return" is negative because applying a tax of 53.8% to mobile broadband services allows the government to directly collect more taxes than applying a tax rate of 54.8%. This is a typical example of higher tax rates decreasing tax collection, without the consideration of the overall impact on the economy.

**Figure 48: Impact on tax revenue (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ (37) | $ 3 | $ 103 |
| | 1.2 | $ (6) | $ 101 | $ 303 |

**Figure 49: Accumulated return required on each tax dollar for wealth creation neutrality**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 1.9 | $ 3.9 | $ 9.0 |
| | 1.2 | $ 3.4 | $ 10.8 | $ 24.9 |

Assuming a Malaysian tax structure shows the enormous effects of broadband on the economy. Additional wealth creation after five years ranges from a conservative US$1.2 billion to a more aggressive US$ 13.4 billion were the estimates of the World Bank used to estimate the impact (see Figure 50). This could come at a cost to the treasury of about US$347 million, but could potentially boost tax collection by US$2.99 billion (see Figure 51).

**Figure 50: Accumulated additional GDP: From 14.9% to 6.1% (in US$ billion)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 1.2 | $ 2.7 | $ 6.3 |
| | 1.2 | $ 1.6 | $ 5.8 | $ 13.4 |

**Figure 51: Impact on tax revenue: From 14.9% to 6.1% (negative numbers represent foregone taxes) (in US$ million)**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ (347) | $ 52 | $ 994 |
| | 1.2 | $ (164) | $ 960 | $ 2,987 |

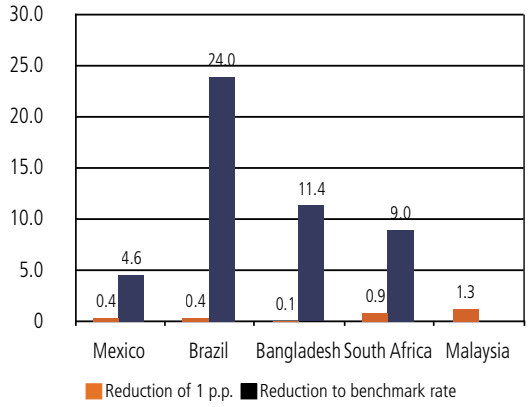
**Figure 52: Accumulated return required on each tax dollar for wealth creation neutrality: From 14.9% to 6.1%**

| | | GDP Elasticity | | |
|---|---|---|---|---|
| | | 0.17 % | 0.60 % | 1.38 % |
| Penetration elasticity | 0.6 | $ 1.8 | $ 4.1 | $ 9.3 |
| | 1.2 | $ 2.7 | $ 9.9 | $ 22.9 |

# 6. Policy Implications

In summary, given that fixed broadband penetration is underdeveloped in all five countries mobile broadband is a key lever to develop the ICT sector. Taxes on mobile services hamper diffusion of this technology, with impact being highest in Brazil and lowest in Malaysia. Mexico's taxation model of mobile services follows the "sector distortion" approach, with a significant impact being achieved on wireless broadband diffusion and, consequently on the economy. In South Africa, the share of taxes in the overall cost of mobile ownership is low, under the developing countries average, while in Bangladesh, the share of taxes is high (very close to Brazil 's level and above the average in developing countries). Only Malaysia combines a pro ICT tax approach with the implementation of a telecommunications strategy. As a result, a reduction in taxation in the countries studied to Malaysia's rate could increase wireless penetration between 4.6 (in Mexico) to 24 (in Brazil) percentage points (see Figure 53).

**Figure 53. Increase in Wireless Penetration Resulting from Changes in Taxation (in percentage points)**



The issues identified in the case studies are not exclusive to the five countries. At least twenty-seven countries around the globe have adopted highly distorting taxation approaches negatively impacting the development of mobile broadband (see figure 54). It is imperative that policy makers examine this situation to make sure that a proper development framework is adopted. According to the taxonomy developed in this study (see section 2), several countries need to examine their taxation policies to make sure that overarching ICT diffusion national strategies are not hampered. Among these countries, we have identified the following:

**Figure 54. List of Countries whose taxation policies might impact the diffusion of mobile broadband**

| | Sector distortion | Tax maximization and sector distortion |
|---|---|---|
| Africa | Kenya, Tanzania, Uganda, Zambia | Burkina Faso, Ghana, Madagascar, Nigeria, Senegal, Tunisia |
| Middle East | Jordan | Iran, Turkey |
| Asia Pacific | Cambodia | Bangladesh, Nepal, Pakistan, Sri Lanka |
| Latin America | Dominican Rep., Ecuador, Mexico, Colombia | Argentina, Brazil, Venezuela |
| Eastern Europe | Albania , Ukraine | |
| Western Europe | Greece | |

The implications for fiscal policy in these and other countries are clear. While it is imperative that governments apply taxes to finance spending and generate externalities in sectors where private investment is lacking, often times these taxation models are not efficient. Developing countries, in particular, face high public funds costs because they implement distorting taxation approaches. Countries need to adopt efficient non-distortion tax policies so as to minimize deadweight losses that may lower their overall national output.

Fiscal policies that apply a special tax to the telecommunications sector are inefficient and cause distortions that "crowd out" private spending and in the end diminish welfare. Private investment in ICT has a strong positive impact on growth and there is robust empirical evidence that suggest that taxation of mobile services appears to have a strong negative impact on the deployment of mobile broadband.

Moreover, we found clear policy inconsistencies between regulations aimed at developing the ICT sector through investment incentives and a culture where ICT firms are perceived as "cash cows" and thus taxes are levied. These inconsistencies may be the result of differences in the various agencies' programs. There appears to be a lack of ICT policy leadership at the highest level that would give coherence to ICT development programs. While effects vary by country, adopting similar levels of taxation as Malaysia could create significant wealth with a relatively low cost to the tax collector.

Furthermore, as mentioned earlier, the main purpose of taxation is to generate revenue to finance public sector activities that deliver their policy objectives including increasing the rate of economic growth. The efficiency of tax policies is determined to a significant degree by a country's economic structure and its administrative capacity.



[16] Examples of sources are Economist Intelligence Unit, Business Environment Risk Intelligence, WEF, World Bank

According to Laffont (2005), developing countries suffer from high costs of public funds which reflect the quality of their tax system. In developing countries:

> "...the marginal cost of public funds, that is, the social cost of raising 1 unit of funds, includes in particular a deadweight loss because governments raise revenue by means of distortion taxes".

Furthermore, the author argues that this deadweight loss generates a cost to citizens of 1.3 units of account every time the government raises 1 unit. (Laffont, 2005).

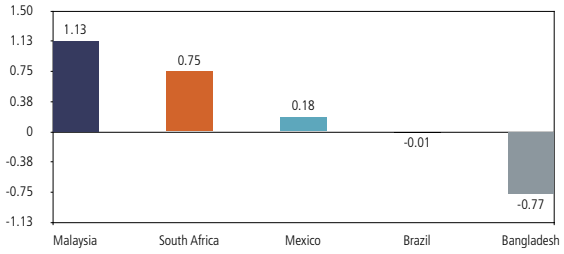
The inefficiency of tax systems in developing countries are a result of institutional weaknesses in enforcement, commitment and auditing. Developing countries lack well developed accounting and auditing systems, they lack checks and balances systems that make governments more vulnerable to capture leakage and they generally have a weak rule of law. Poor enforcement of laws and contracts leads to highly incomplete contracts and costly negotiations. These inefficiencies in developing countries erode their capacity to effectively formulate and implement sound government spending.

There are inherent difficulties in measuring the effectiveness of government spending using any kind of data. Moreover, as it is almost impossible to estimate the spillover effects of marginal government spending, we have used as a proxy the "Government Effectiveness Index" published by the World Bank. It captures perceptions of the quality of public services through surveys applied to 14 sources[16], and measures quality of the civil service and the degree of its independence from political pressures, quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. It ranges from -2.5 to 2.5, where 2.5 is maximum effectiveness of a government. It also captures the efficiency of fiscal policy (taxes and spending) as it identifies the effect of the following variables:

- Consistency between planning and spending execution
- Efficiency of revenue mobilization / public expenditures
- Budget management
- The efficiency of the country's tax collection system.

When we compare the countries selected in this document as our case studies we find that, according to this index, the lowest governance effectiveness is observed in Bangladesh and Brazil, where telecommunications taxes are higher, and the highest in Malaysia, where the taxes are lowest. This is consistent and supports Laffont's argument that developing countries face high public funds costs because they implement distortion taxes. That is, in our sample, governments that have a higher level of telecom taxation have less effective governance (see figure 55).

**Figure 55. Government Efficiency Index**




Source: World Bank (2009) (http://info.worldbank.org/governance/wgi/mc_chart.asp); TAS analysis

The policy implications of this situation are twofold. Emerging countries need to align taxation approaches affecting mobile broadband with ICT national objectives. If mobile broadband is understood as a key social and economic development lever, taxes cannot represent an obstacle for diffusion. In this context, the study indicates that a reduction in taxes affecting mobile broadband will translate into higher service adoption, which ultimately generates additional GDP.

# Appendices

## A. Study Team

- **Dr. Raul Katz** (Ph.D., Management Science and Political Science, Massachusetts Institute of Technology) is currently Director of Business Strategy Research at the Columbia Institute for Tele-Information, Adjunct Professor in the Division of Economics and Finance at Columbia Business School (New York), and President of Telecom Advisory Services, LLC. He worked for twenty years at Booz Allen Hamilton, where he was the Head of the Telecommunications Practice in North and Latin America and member of its Leadership Team. He has conducted several studies on the economic impact of broadband (US, Germany, Switzerland, Latin American region) as well as an assessment of the impact of new taxation on ICT diffusion in Argentina.

- **Dr. Ernesto Flores-Roux** (Ph.D., Statistics, University of Chicago) is a Researcher at the Centro de Investigación y Docencia Economica (CIDE) (Mexico). He is a former government official at Mexico's Ministry of Communications and a former Partner of McKinsey & Co., having acted as the location manager of the firm's Rio de Janeiro Office from 2002 until 2004. Afterwards, he was the Director of Marketing and Strategy for Telefónica Movistar Mexico (2004-2006) and the Director of Strategy for Telefonica in Asia.

- **Dr. Judith Mariscal** (Ph.D., Public Policy, UT in Austin) is a Professor at the Centro de Investigación y Docencia Económica (CIDE) (Mexico) where she is the Director of the Telecommunications Research Program, Telecom-CIDE, a leading organization focused on telecommunications policies. Professor Mariscal is member of DIRSI's Steering Committee, the Program Committee for TPRC (Telecommunications Policy Research Conference) and Social Witness for International Transparency, Chapter Mexico, and has been advisor to the Mexican Regulatory Agency and Communications Ministry as well as the World Bank and ITU. She has written and published numerous articles and book chapters centered on telecommunications as well as two books.

- **Armando Aldama** (MA, Public Policy, Centro de Investigación y Docencia Económicas (CIDE) in Mexico City) has been Research Assistant at Telecom – CIDE and DIRSI since 2007 where he has collaborated in numerous research projects related to ICT access and regulation.

- **Javier Avila** (MS, Applied Economics, and University of Chile) is a consultant at Telecom Advisory Services, LLC. Prior to joining TAS LLC, Mr. Avila was a regulatory analyst with VTR in Chile.

## B. Database of taxation approaches

### 1. Taxes on Services

| | VAT or similar taxes | Other Taxes | Fixed taxes (US$) | VAT | Specific | Fixed | Matrix 1 | Concatenate | Group |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| **AFRICA** | | | | | | | | | |
| Angola | 5.0% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Botswana | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Burkina Faso | 18.00% | | 0.04-0.10 | 2 | 0 | 2 | 20 | 202 | Grupo 3 |
| Cameroon | 19.25% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Chad | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Cote d'Ivoire | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| DRCongo | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Egypt | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Ethiopia | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Gabon | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Gambia | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Ghana | 12.50% | 2.50% | | 2 | 1 | 0 | 21 | 210 | Grupo 3 |
| Guinea | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Guinea-Bissau | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Kenya | 16.00% | 10.00% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Lesotho | 5.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Madagascar | 18.00% | 8.00% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Mauritania | 14.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Mauritius | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Morocco | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Mozambique | 17.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Nigeria | 5.00% | 8.00% | | 1 | 2 | 0 | 12 | 120 | Grupo 3 |
| Rwanda | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Senegal | 18.00% | | 7.18 | 2 | 0 | 2 | 20 | 202 | Grupo 4 |
| Seychelles | 17.60% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Sierra Leone | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| South Africa | 14.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Swaziland | | | | 0 | 0 | 0 | 00 | 000 | Grupo 1 |
| Tanzania | 20.00% | 7.00% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Tunisia | 18.00% | 5.00% | | 2 | 1 | 0 | 21 | 210 | Grupo 3 |
| Uganda | 18.00% | 12.00% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Zambia | 17.50% | 10.00% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Zimbabwe | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |

Note: Columns (4), (5) and (6) represent codes defined according to tax levels of columns (1), (2) and (3); columns (8) and (9) combine codes and determine the type of taxation approach by country: Group 1 (Universalization of Services); Group 2 (Direct taxation without sector discrimination); Group 3 (Direct taxation and sector specific taxes); Group 4 (Maximize tax revenues).

| | VAT or similar taxes | Other Taxes | Fixed taxes (US$) | VAT | Specific | Fixed | Matrix 1 | Concatenate | Group |
|---|---|---|---|---|---|---|---|---|---|
| **MIDDLE EAST** | | | | | | | | | |
| Iran | 6.00% | | 4.33 for pre- | 1 | 0 | 2 | 10 | 102 | Grupo 3 |
| Jordan | 16.00% | 4.00% | | 2 | 1 | 0 | 21 | 210 | Grupo 3 |
| Syria | 3.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Turkey | 18.00% | 25.00% | 23.86 | 2 | 2 | 2 | 22 | 222 | Grupo 4 |
| Yemen | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| **ASIA PACIFIC** | | | | | | | | | |
| Bangladesh | 15.00% | 35.00% | 11.76 | 2 | 2 | 2 | 22 | 222 | Grupo 4 |
| Bhutan | | | | 0 | 0 | 0 | 00 | 000 | Grupo 1 |
| Cambodia | 10.00% | 3.00% | | 1 | 1 | 0 | 11 | 110 | Grupo 3 |
| China | 3.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| India | 12.24% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Indonesia | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Lao | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Malaysia | 5.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Myanmar | 0.00% | | | 0 | 0 | 0 | 00 | 000 | Grupo 1 |
| Nepal | 13.00% | 10.00% | 20.15 | 2 | 2 | 2 | 22 | 222 | Grupo 4 |
| Pakistan | 15.00% | | 8.30 | 2 | 0 | 2 | 20 | 202 | Grupo 4 |
| Papua New Guinea | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Philippines | 12.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Samoa | 12.50% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Sri Lanka | 15.00% | 2.50% | | 2 | 1 | 0 | 21 | 210 | Grupo 3 |
| Thailand | 7.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Vietnam | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| **LATIN AMERICA** | | | | | | | | | |
| Argentina | 21.00% | 4.00% | | 2 | 1 | 0 | 21 | 210 | Grupo 3 |
| Bolivia | 13.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Brazil | 33.00% | 3.00% | | 2 | 1 | 0 | 21 | 210 | Grupo 3 |
| Chile | 19.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Colombia | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Dominican Republic | 16.00% | 12.00% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Ecuador | 12.00% | 15.00% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Guatemala | 12.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Mexico | 16.00% | 3.00% | | 2 | 1 | 0 | 21 | 210 | Grupo 3 |
| Nicaragua | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Paraguay | 10.00% | | | 1 | 0 | 0 | 10 | 100 | Grupo 1 |
| Peru | 19.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Trinidad and Tobago | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Venezuela | 14.00% | | 1.56-6.25 | 2 | 0 | 2 | 20 | 202 | Grupo 4 |

| | VAT or similar taxes | Other Taxes | Fixed taxes (US$) | VAT | Specific | Fixed | Matrix 1 | Concatenate | Group |
|---|---|---|---|---|---|---|---|---|---|
| **RUSSIA/CIS/CENTRAL AND EASTERN EUROPE** | | | | | | | | | |
| Albania | 20.00% | | Post pay 59 | 2 | 0 | 2 | 20 | 202 | Grupo 4 |
| Azerbaijan | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Georgia | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Kazakhstan | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Russia | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| Ukraine | 20.00% | 7.50% | | 2 | 2 | 0 | 22 | 220 | Grupo 4 |
| Uzbekistan | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 2 |
| **WESTERN EUROPE** | | | | | | | | | |
| Austria | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Bulgaria | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Cyprus | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Czech Republic | 19.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Denmark | 25.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Estonia | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| France | 19.60% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Finland | 22.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Germany | 16.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Greece | 19.00% | | 1.92-5.75 | 2 | 0 | 2 | 20 | 202 | Grupo 4 |
| Hungary | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Ireland | 21.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Italy | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Latvia | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Lithuania | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Luxembourg | 15.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Malta | 18.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Netherlands | 19.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Poland | 22.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Portugal | 21.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Romania | 19.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Slovakia | 19.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Slovenia | 20.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Spain | 16.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| Sweden | 25.00% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |
| UK | 17.50% | | | 2 | 0 | 0 | 20 | 200 | Grupo 1 |

## 2. Taxes on handsets

| | VAT or similar taxes | Custom Duty* | Other Taxes | Fixed taxes (US$) | VAT | Customs | Fixed | Telecoms | Matrix 1 | Matrix 2 | Filter | Group Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| **AFRICA** | | | | | | | | | | | | |
| Angola | 10.00% | 5.00% | | | 1 | 1 | 0 | 0 | 11 | 00 | 1100 | Grupo 1 |
| Botswana | 10.00% | | 7.00% | | 1 | 0 | 0 | 2 | 10 | 02 | 1002 | Grupo 3 |
| Burkina Faso | 18.00% | 13.30% | 1.00% | | 2 | 2 | 0 | 1 | 22 | 01 | 2201 | Grupo 3 |
| Cameroon | 19.25% | 29.90% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Chad | 18.00% | 28.50% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Cote d'Ivoire | 18.00% | 5.00% | 2.50% | | 2 | 1 | 0 | 1 | 21 | 01 | 2101 | Grupo 3 |
| DRCongo | 13.00% | 19.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Egypt | 10.00% | | | | 1 | 0 | 0 | 0 | 10 | 00 | 1000 | Grupo 1 |
| Ethiopia | 15.00% | 10.00% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Gabon | 18.00% | 9.50% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Gambia | 15.00% | 20.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Ghana | 12.50% | 9.50% | 5.50% | | 2 | 1 | 0 | 2 | 21 | 02 | 2102 | Grupo 3 |
| Guinea | 18.00% | 11.90% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Guinea-Bissau | 15.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Kenya | 16.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Lesotho | 14.00% | 0.00% | 7.00% | | 2 | 0 | 0 | 2 | 20 | 02 | 2002 | Grupo 3 |
| Madagascar | 18.00% | 9.50% | 3.00% | | 2 | 1 | 0 | 1 | 21 | 01 | 2101 | Grupo 3 |
| Mauritania | 14.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Mauritius | 15.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Morocco | 20.00% | 2.50% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Mozambique | 17.00% | 25.00% | 1.00% | | 2 | 2 | 0 | 1 | 22 | 01 | 2201 | Grupo 3 |
| Nigeria | 5.00% | 9.50% | 7.50% | | 1 | 1 | 0 | 2 | 11 | 02 | 1102 | Grupo 3 |
| Rwanda | 18.00% | 30.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Senegal | 18.00% | 10-20.00% | 1.50% | | 2 | 2 | 0 | 1 | 22 | 01 | 2201 | Grupo 3 |
| Seychelles | | 12.00% | | | 0 | 2 | 0 | 0 | 02 | 00 | 0200 | Grupo 2 |
| Sierra Leone | 10.00% | | | | 1 | 0 | 0 | 0 | 10 | 00 | 1000 | Grupo 1 |
| South Africa | 14.00% | 7.60% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Swaziland | | 14.00% | | | 0 | 2 | 0 | 0 | 02 | 00 | 0200 | Grupo 2 |
| Tanzania | 20.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Tunisia | 10.00% | | 8.00% | | 1 | 0 | 0 | 2 | 10 | 02 | 1002 | Grupo 3 |
| Uganda | 18.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Zambia | 17.50% | 4.80% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Zimbabwe | 15.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |

Note: Columns (5), (6), (7) and (8) represent codes defined according to tax levels of columns (1), (2), (3) and (4); columns (9), (10) and (11) combine codes and determine the type of taxation approach by country: Group 1 (Sector discrimination limited to import duty); Group 2 (Sector discrimination based on moderate duty and telecom tax); Group 3 (Sector discrimination based on handset specific tax); Group 4 (Maximize tax revenues).

| | VAT or similar taxes | Custom Duty* | Other Taxes | Fixed taxes (US$) | VAT | Customs | Fixed | Telecoms | Matrix 1 | Matrix 2 | Filter | Group Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MIDDLE EAST** | | | | | | | | | | | | |
| Iran | | 60.00% | | | 0 | 2 | 0 | 0 | 02 | 00 | 0200 | Grupo 2 |
| Jordan | 0.00% | 0.00% | | | 0 | 0 | 0 | 0 | 00 | 00 | 0000 | Grupo 1 |
| Syria | 20.00% | 10.00% | | 14.38-33.67 | 2 | 1 | 2 | 0 | 21 | 20 | 2120 | Grupo 3 |
| Turkey | 18.00% | | 20.00% | | 2 | 0 | 0 | 2 | 20 | 02 | 2002 | Grupo 3 |
| Yemen | 5.00% | 5.00% | 3.00% | | 1 | 1 | 0 | 1 | 11 | 01 | 1101 | Grupo 3 |
| **ASIA PACIFIC** | | | | | | | | | | | | |
| Bangladesh | 15.00% | 12.00% | | 11.63 | 2 | 2 | 2 | 0 | 22 | 20 | 2220 | Grupo 4 |
| Bhutan | 10.00% | 30.00% | | | 1 | 2 | 0 | 0 | 12 | 00 | 1200 | Grupo 2 |
| Cambodia | 10.00% | 10.00% | | | 1 | 1 | 0 | 0 | 11 | 00 | 1100 | Grupo 1 |
| China | 17% or 3% | 20.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| India | 4.00% | 13.00% | | 1.36 | 1 | 2 | 1 | 0 | 12 | 10 | 1210 | Grupo 3 |
| Indonesia | 10.00% | 18.00% | | | 1 | 2 | 0 | 0 | 12 | 00 | 1200 | Grupo 2 |
| Lao | 10.00% | 10.00% | | | 1 | 1 | 0 | 0 | 11 | 00 | 1100 | Grupo 1 |
| Malaysia | 10.00% | | | | 1 | 0 | 0 | 0 | 10 | 00 | 1000 | Grupo 1 |
| Myanmar | 0.00% | 21.00% | | | 0 | 2 | 0 | 0 | 02 | 00 | 0200 | Grupo 2 |
| Nepal | 13.00% | 5.00% | 1.50% | | 2 | 1 | 0 | 1 | 21 | 01 | 2101 | Grupo 3 |
| Pakistan | | | | 6.00 | 0 | 0 | 1 | 0 | 00 | 10 | 0010 | Grupo 3 |
| Papua New Guinea | 10.00% | 0.00% | | | 1 | 0 | 0 | 0 | 10 | 00 | 1000 | Grupo 1 |
| Philippines | 12.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Samoa | 12.50% | 20.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Sri Lanka | | 33.00% | | | 0 | 2 | 0 | 0 | 02 | 00 | 0200 | Grupo 2 |
| Thailand | 7.00% | | | | 1 | 0 | 0 | 0 | 10 | 00 | 1000 | Grupo 1 |
| Vietnam | 10.00% | 7.50% | | | 1 | 1 | 0 | 0 | 11 | 00 | 1100 | Grupo 1 |
| **LATIN AMERICA** | | | | | | | | | | | | |
| Argentina | 21.00% | 0%-20% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Bolivia | 13.00% | 10.00% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Brazil | 33.00% | 19.00% | 9.30% | 13.35 | 2 | 2 | 2 | 2 | 22 | 22 | 2222 | Grupo 4 |
| Chile | 19.00% | 6.00% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Colombia | 16.00% | 5.00% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Dominican Republic | | | | | 0 | 0 | 0 | 0 | 00 | 00 | 0000 | Grupo 1 |
| Ecuador | 12.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Guatemala | 12.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Mexico | 16.00% | 0.10% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Nicaragua | 15.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Paraguay | 10.00% | 3.00% | | | 1 | 1 | 0 | 0 | 11 | 00 | 1100 | Grupo 1 |
| Peru | 19.00% | 4.00% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Trinidad and Tobago | 15.00% | 25.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Venezuela | 14.00% | 14.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |

| | VAT or similar taxes | Custom Duty* | Other Taxes | Fixed taxes (US$) | VAT | Customs | Fixed | Telecoms | Matrix 1 | Matrix 2 | Filter | Group Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RUSSIA/CIS/CENTRAL AND EASTERN EUROPE** | | | | | | | | | | | | |
| Albania | 20.00% | 0.00% | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Azerbaijan | 18.00% | 15.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Georgia | 18.00% | 12.00% | | | 2 | 2 | 0 | 0 | 22 | 00 | 2200 | Grupo 2 |
| Kazakhstan | 15.00% | 0.00% | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Russia | 18.00% | 5.00% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| Ukraine | 20.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Uzbekistan | 20.00% | 0.20% | | | 2 | 1 | 0 | 0 | 21 | 00 | 2100 | Grupo 1 |
| **WESTERN EUROPE** | | | | | | | | | | | | |
| Austria | 20.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Bulgaria | 20.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Cyprus | 15.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Czech Republic | 19.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Denmark | 25.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Estonia | 18.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| France | 19.60% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Finland | 22.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Germany | 16.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Greece | 19.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Hungary | 20.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Ireland | 21.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Italy | 20.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Latvia | 18.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Lithuania | 18.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Luxembourg | 15.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Malta | 18.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Netherlands | 19.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Poland | 22.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Portugal | 21.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Romania | 19.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Slovakia | 19.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Slovenia | 20.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Spain | 16.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| Sweden | 25.00% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |
| UK | 17.50% | | | | 2 | 0 | 0 | 0 | 20 | 00 | 2000 | Grupo 1 |

## C. Case studies: country context

### 1. Mexico:

Incumbent telecommunications carrier (Telmex) was sold in 1990 to a group of private investors (Grupo Carso, Southwestern Bell and France Telecom). As part of enhancing the sale price and to strengthen it before it would compete with other firms, it was awarded a six year monopoly on long distance services and the B Band spectrum for mobile telephony. Local service was open to competition, but no licenses were awarded until 1996[17]. The Band A concessions began offering competitive mobile services in 1989. The mobile sector, following international trends, was structured as a duopoly. Intercompany roaming was not available, giving a large competitive advantage to Telmex/Telcel, as it was the only carrier having a nationwide footprint

In 1995, Congress passed the Federal Law of Telecommunications, which is the main piece of legislation regulating the sector. The law fully opened the sector to competition[18], created a national independent regulator (Cofetel), and provided a general framework for interconnection. Despite the intended administrative and technical independence of Cofetel, this agency continues to report to the Ministry of Communications, SCT, thus creating an inefficient policy process.

Several new entrants into the long distance market started offering services in 1996; the fixed local market saw a few new entrants. Point-to-point wireless links were auctioned the same year. It was not until 1999 that PCS spectrum (1.9 GHz) was auctioned. Two national licenses (divided in regional concessions) were awarded; Unefón (Grupo Salinas, who later bought Iusacell from Bell Atlantic and Vodafone) and Pegaso. During the process, Telmex (through its mobile subsidiary, Telcel) also acquired spectrum. One concession (Region 8) was awarded to a local investor; this spectrum remains unused. Band A and Band B were operating TDMA technology, while Pegaso and Unefón launched CDMA services.

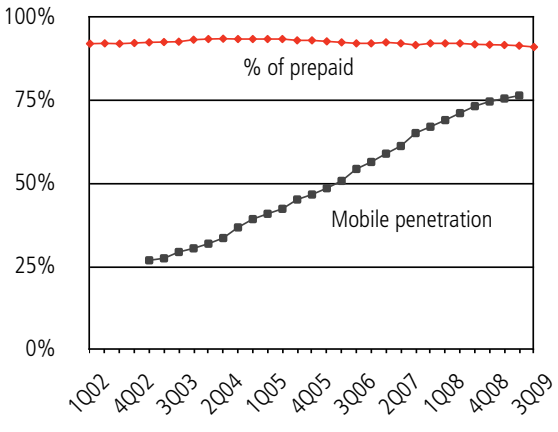
In 2001, Telmex spun off Telcel, creating América Móvil. Also in 2001, Telefónica acquired the Motorola Band A operations; in 2003 it acquired a majority stake in Pegaso. Both companies changed their platforms to GSM technology.

A trunking operator (Nextel), since the late 90s, through the acquisition of smaller operators, built a nationwide presence offering PTT services. The network was interconnected to the main network under disadvantageous conditions, but its service has proven to be extremely successful. Though with a relatively small market share (less than 5%), it boasts an ARPU almost 4 times higher than America Movil and Telefonica. In 2009 it was granted the same operating and interconnection conditions as the other mobile players.

In 2005, a process to award new spectrum licenses was begun, but was eventually stopped by several interested parties (Grupo Salinas being the most vocal one). A new process was started in 2008 and is still under way.

Growth has been consistent since the late 90s. As of October 2009, there were 78.9 MM users (72% penetration). Cofetel does not report how many of these are broadband users; the ITU reported (Dec. 2008) 1.9 MM mobile broadband users. Total broadband users in Mexico (fixed and mobile), according to Point Topic, amount to 9.3 million users (see Figure C.1).

**Figure C.1. Mexico: Wireless subscribers**



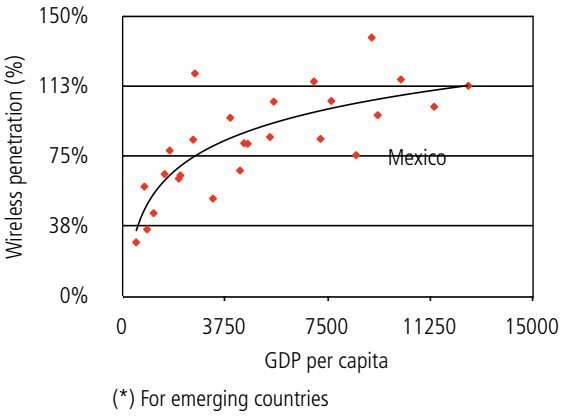

Sources: ITU; Wireless Intelligence

[17] Even so, there were no interconnection regulations that would have allowed competition until 1998.

[18] The law provided for uncapped foreign direct investment only in mobile telephony (full foreign ownership for fixed and other telecommunications services is still widely discussed in Congress 15 years later).

The mobile market in Mexico reported a penetration of 72 %, of which 91% are prepaid subscribers; a low performance for the size of its economy. A compulsory registration system for all active phones entered into effect in 2009. At the time this report was written, there was still an on-going debate whether to disconnect those lines that did not register; if that is the case, penetration is bound to decrease by about 20%.

**Figure C.2. Mobile subscribers and economic development (2009)**

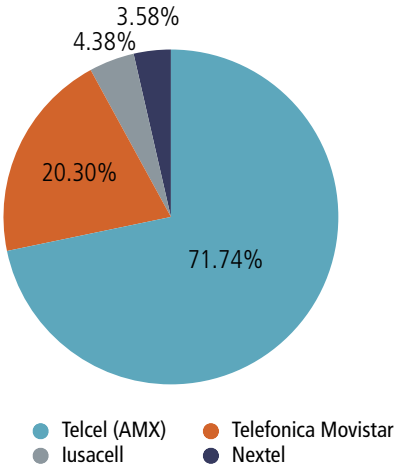



Sources: ITU; World Bank; TAS analysis

Growth in the number of internet users and broadband subscribers has continued given a competitive market and investment in new access technologies. However, even though there is extensive mobile coverage in Mexico's major urban areas, many rural parts of the country that need significant outlay of telecommunications infrastructure are not covered. The auction of additional spectrum – expected to occur sometime in 2010 - should should provide increased competition with operators offering a wider range of services over their networks.

The industry includes four operators; the market structure, with one player concentrating more than 70% of the total number of subscribers, is frequently considered to have shown limited effects from competition (see Figure C.3).

**Figure C.3. Mexico: Mobile Industry structure (2009)**




Source: Wireless Intelligence

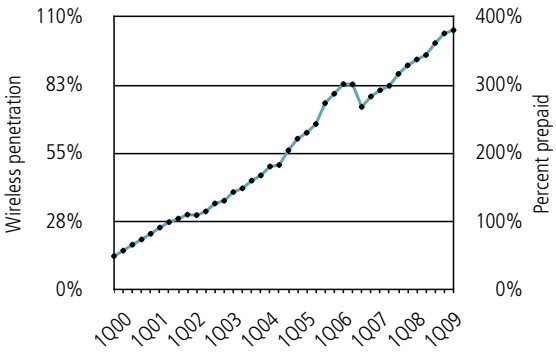
## 2. Malaysia

Malaysia was one of the first Asian countries to introduce reforms in the telecommunications sector. Since 1987, when the public firm known as Jabatan Telekom Malaysia was privatized and converted to Syrarikat Telekom Malaysia, it faced competition from operators in the mobile and long distance segment of the market. The liberalization and privatization policies implemented in the 1980s set the rules for market forces to play a major role in the sector. A decade later, new legislation strengthened the regulatory structure and their institutions. The Communications and Multimedia Commission was established in 1998 as the regulatory body in telecommunications (CMC). However, it has limited powers as it only provides recommendations to the Ministry of Energy, Communications and Multimedia, which is the most influential institution in the sector. Transparency in the design of regulatory policies has been a fundamental characteristic of regulation in Malaysia; since early on the Malaysia's Communications and Multimedia Act 1998 (CMA) provided for public inquiries on regulatory matters.

Licensees under the Communications and Multimedia Act of 1998 paved way for convergence as it was formulated to be both technology and service neutral in four generic categories: Network facility providers, Network service providers, Application service providers, and Content applications service providers. This forward vision offered a more effective utilization of network infrastructure.

Malaysia has three well-established mobile operators and five operators licensed to provide 3G services. Pro-competition regulatory policies created a mature mobile market with a penetration of more than 100% (see Figure C.4).

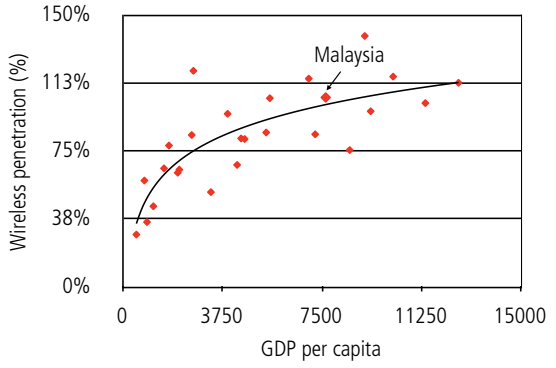
**Figure C.4. Malaysia: Mobile Subscribers**




Source: Wireless Intelligence

Demand for mobile broadband has continued to rise steadily; the number of total subscribers was up by 52.9% in 2009 and 25.2% growth during 2008. This mobile market growth is reflected in its good level of economic development, which is one of the best among developing countries (see Figure C.5).

**Figure C.5. Mobile Subscribers and Economic Development (*) (2009)**

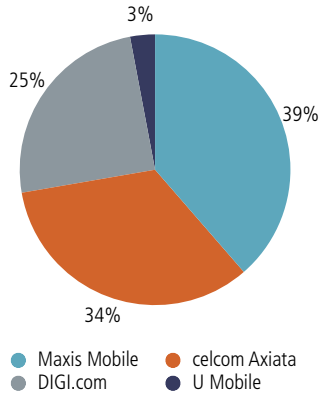



(*) For emerging countries

Sources: ITU; World Bank; TAS analysis

As of today, the wireless industry comprises four operators (see Figure C.6).

**Figure C.6: Malaysia: Wireless Industry Structure (2009)**




Source: Wireless Intelligence

The wireless operators are focused on offering broadband services:

- Maxis provides HSPA-based wireless broadband Internet access, together with Celcom and new cellular telephone company uMobile
- DiGi currently provides EDGE-based wireless connectivity and expects to launch HSPA-based wireless broadband service using Time dotCom's 3G license in early 2009. GPRS services are available via 2.5 G mobile services

A government study indicated that by 2008, 39.4% of wireless subscribers were using 3G as their primary broadband connection (MCMC Mobile Broadband Study, 2008). 3G upgrades to HSDPA have improved service quality and demand is strong; 3G device penetration reached 12.4% of total population.

Fixed broadband has been deploying at a relatively slow pace, which has prompted the need to emphasize wireless broadband as an alternative platform. Fixed broadband penetration as of 2009 was at 23% of households, most of it concentrated in urban areas; the government objective is to reach 50% penetration by the end of 2010. To reach this target, the government has issued new spectrum licenses to four companies that will roll out new wireless broadband services based on Wimax platforms.

Coverage targets stipulate that the companies should reach 40% of the population by March 2011, with commitments to reach into outer regions. To rationalize capital investment, the government has forced sharing agreements for towers among HSDPA and Wimax operators.

Launched in September 2008, Malaysia's high speed broadband project is a 10 year collaborative effort by incumbent telephone company Telekom Malaysia (TM) and Malaysia's Ministry of Energy, Water and Communications to provide fixed broadband connectivity nationwide; under its first phase, it aims to provide access to over 1.3 million premises by 2012. TM will provide the last mile access homes and businesses using fiber-to-the home (FTTH), Ethernet-to-the-home (ETTH), and Very High Speed Digital Subscriber Line (VDSL2) technologies. This will provide homes with broadband speeds between 10Mbps and 100Mbps, and up to 1Gbps to businesses. The government will contribute US$685 million towards the project, while TM will provide US$2.54 billion. The government's part is mostly to make up for lower net present value in areas such as new housing estates and new industrial zones, which are regarded as commercially non-profitable for telecommunications companies.

Wireless broadband deployment is supported by relying on the proceeds of the Universal Service Provision Fund (worth USD 573 million), as well as tax incentives on investment in broadband infrastructure.

### 3. Brazil

Brazil was a late comer to the restructuring of its telecommunications sector and as such, was able to leverage significant international experience. In less than five years, its telecom sector became vibrant, well ahead of most countries with similar economic conditions. In 1994, the plan of the incoming president called for the restructuring of the sector, allowing for private capital; as of then, the sector was a state-owned monopoly, both in fixed and mobile services. In 1995, a plan to auction B band licences was approved and was carried out in 1996. Telebrás was split up into 13 companies (3 fixed local, 1 LD, 8 mobile, 1 holding with work-related liabilities) and privatized in 1998. No cross-ownership (fixed-mobile) was allowed within the same geographical region.

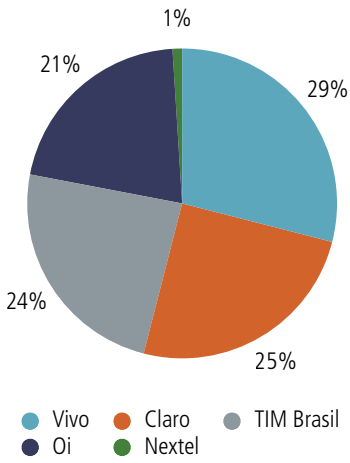
Heavy investment requirements during privatization provided for growth to be almost 200% in less than five years. In 2001, new spectrum was licensed (PCS – 1.9 GHz), allowing fixed line carriers to participate in the bid. Telemar/Oi and Brasil Telecom (fixed incumbents in south/centre and north/northeast) acquired licenses, thus being able to offer bundled services and TIM completed its nationwide footprint. Through a joint venture (together with Portugal Telecom) and an acquisition spree, Telefonica built an (almost) national presence (Minas Gerais excluded at the time; it finally bought Telemig in 2008). Since 2001, America Movil started acquiring (mostly) B band licenses; by 2004 it already had a nationwide footprint. Telmex, with heavy ownership links with America Movil, acquired the long distance company (Embratel), as well as several cable TV providers. In 2010 they announced that they would merge operations (America Movil will acquire Telmex Internacional). Thus, the Brazilian telecommunications is becoming increasingly concentrated.

In 2007 new licenses were awarded, providing spectrum for 3G services. A small new entrant and Oi acquired spectrum in Sao Paulo. Incumbent companies (America Movil, Vivo/Telefonica/PT, TIM) also acquired more spectrum. A Band and B Band licenses operated TDMA and CDMA systems. The fixed line incumbents and TIM launched GSM operations. Vivo switched to GSM technology in 2007.

When Telefonica acquired a stake in Telecom Italia, discussions started about whether TI should divest TIM Brasil or whether Telefonica should divest Vivo. Though the structure has not changed since, it is still an issue that is being debated; a likely acquisition of TI by Telefonica will probably resolve the issue, as the operator either sells Vivo or or TIM Brasil. At the time this report was finalized, Telefonica had made a bid to acquire Portugal Telecom's stake in Vivo. In 2008, Oi/Telemar acquired, with the Government's support, Brazil Telecom (fixed and mobile). When this operation was approved, a somewhat steady market structure emerged.

The mobile sector is divided into four main operators: Vivo, Claro (America Movil), TIM Brazil and Oi. Nextel has a moderate participation of 1% of total market. The other four companies share almost a quarter of Brazilian consumers, but the most important company is Vivo (see Figure C.7).

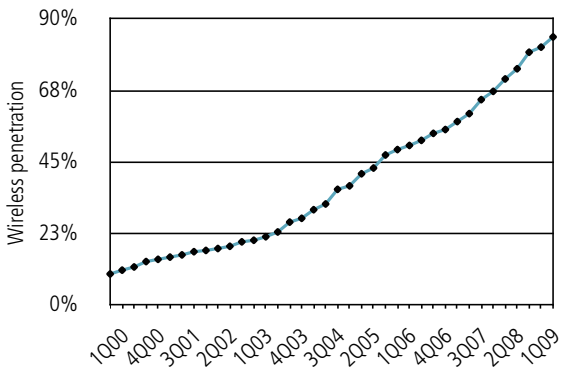
**Figure C.7. Brazil: Mobile industry structure**




Source: Wireless Intelligence

Mobile growth has continued to slow and net additions are lower. However, wireless penetration reached 89% in 2009. Even more, the size of the Brazilian market means that it still adds a large number of new customers each quarter, providing plenty of opportunities for the country's mobile operators. 3G has proven very popular and will help to keep driving the market forward as operators increasingly look to provide services in more remote areas. Concession holders are required to expand services in accordance with the terms of their licenses but new growth will come from these areas in any case, meaning operators are already looking outside major towns and cities in order to maintain their growth rates (see Figure C.8).

**Figure C.8. Brazil Wireless Penetration**




Source: Wireless Intelligence

The Brazilian mobile market has the advantage of a healthy competition; 3G take-up already reached 2.8 million by 2008. However, there are several remote areas of the country that are still without telecommunications infrastructure, and reaching these will be costly.

### 4. Bangladesh

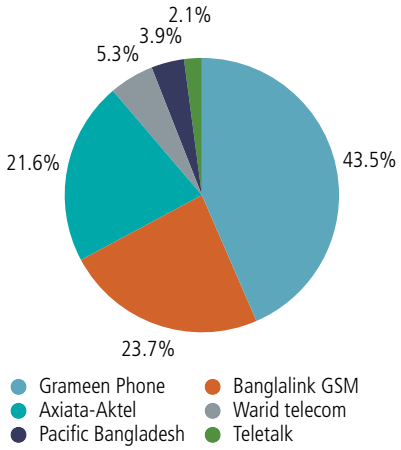
The Bangladeshi telecommunications sector was opened to competition with the 1998 National Telecommunications Policy and 2001 Telecommunications Act. The market is regulated by an independent agency, the Bangladesh Telecommunication Regulatory Commission (BTRC) that was created in 2002 and is responsible for licensing operators, ensuring compliance with license terms and conditions, managing radio spectrum, monitoring quality of telecoms services, settling interconnection disputes and approving tariffs. The Ministry of Posts and Telecommunications (MoPT) acts as policy maker in the sector.

An amendment of the Telecommunications Act of 2001 was approved by parliament on 19 July 2010. This bill has transferred some regulatory powers (such as issuing licences and fixing tariffs) from BTRC to the telecoms ministry and introduces a Universal Service Tax in form of a Social Obligation Fund although the country's more than 98% of landmass and population are already under mobile coverage.

Nationwide operating licenses were issued to Hutchison Bangladesh Telecom Limited (HBTL) for mobile and fixed wireless applications and to Bangladesh Rural Telecom Authority (BRTA) for rural telephony. Pacific Bangladesh Telecom (PBTL) acquired HBTL in 1991. Since then four licensed private sector mobile operators and a number of value added service providers, including Internet Service Providers, have entered the Bangladeshi market.

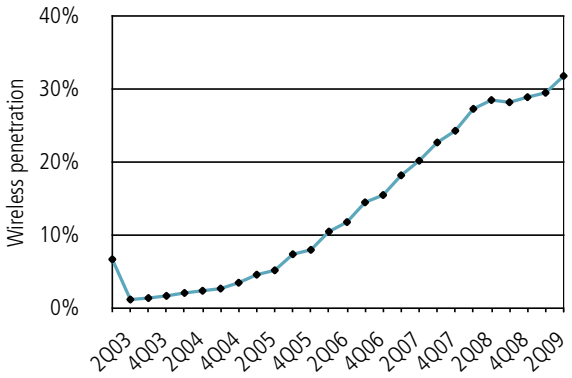
The fixed segment of the market continues to be dominated by the state-owned enterprise and the low level of investments depends on the government's scarce availability of funds. The mobile sector has received a more steady flow of investment led by GrameenPhone. Six main operators are present in the mobile market, but GrameenPhone is the dominant player (see Figure C.9).

**Figure C.9. Bangladesh Mobile Industry Structure**




Source: Wireless Intelligence

**Figure C.10. Bangladesh Wireless Penetration**




Sources: Wireless Intelligence

According to the World Bank, the telecommunications sector of Bangladesh has "fallen far short of its potential and remains a significant constraint to economic growth." Weak levels of competition as well as low private investment are the two main causes of this poor sector performance. Moreover, spectrum management has been inefficient with irregular issuance of frequencies with allegations of conflicts of interest. Overall, the regulatory environment in Bangladesh is ineffective and the public sector is hampering the growth of private investment in the sector.

Bangladesh has entered the mobile data wave, although 3G operation is still delayed as the licensing process has been postponed. However, mobile internet and data services have grown rapidly recently, with the majority of the nation's estimated four million internet users reportedly accessing the web via cellular networks.

GrameenPhone launched EDGE in September 2005 before expanding the 2.5G network to all areas of the country. Major GSM operators are interested in moving up to 3G technology. Three licenses are expected to be offered; the government has indicated one set of 2100MHz frequencies will be reserved for Teletalk, and has set a target of 1.5 million 3G users for the state-run Cellco in the next few years.

The Bangladeshi mobile market has benefited from a rapidly expanding mobile sector: penetration was just 38% at the end of 2009, thus there is a significant growth potential (see Figure C.10).

New deployment will be observed as broadband wireless access licenses were issued in September 2008, with each license requiring the deployment of 90 base stations. This market also benefits from the presence of several key strategic investors, including Telenor of Norway, Malaysia's Axiata, Egypt's Orascom and SingTel of Singapore. Auction of 3G licenses presents opportunity for new foreign investors to enter this high-growth market. Vietnam's Viettel is looking to invest a 60% stake in Teletalk, while India's Bharti is looking to invest in Warid.

Moreover, the government intends to expand broadband internet access to villages where 70% of the population lives. BTCL contracted KT Corp in March 2009 to install a new IP backbone, expanding the availability of broadband services in the country. This forms part of the Internet Information Network Expansion project, being jointly financed by the Bangladeshi and South Korean governments. The current government's election pledges to create a 'digital Bangladesh', with the aim of supporting economic growth. However, in a contradictory policy, the slower rate of growth in 2009, which saw 9.8 MM net additions as compared to 10.0 MM net additions in 2008, was the result of SIM taxation introduced by the government.

### 5. South Africa

Regulation of South Africa's telecoms industry is divided between the Department of Communications and the Independent Communications Authority of South Africa (ICASA). During the last decade, South African authorities have implemented numerous reforms in the telecommunications sector that

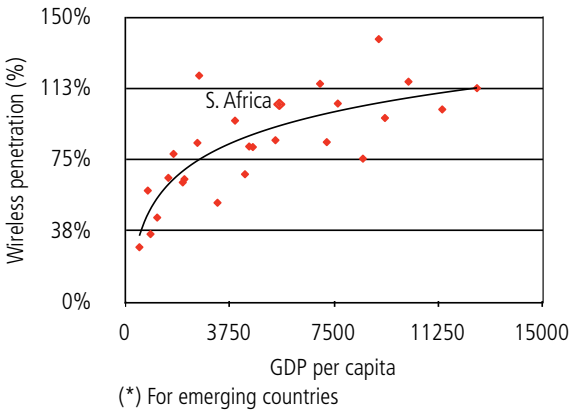
have had limited impact. The initial reform, the liberalization of the market, and the privatization of the incumbent Telkom did not achieve competition as Telkom retained tight control over the local loop and the majority of transport links, while its rivals were not permitted to provide a full range of wireline services. Improved access to voice communications actually came through the introduction of pre-paid mobile services.

During the second round of reforms, with the enactment of the 2001 Telecommunications Amendment Act, the state changed its strategy from one of market liberalization to one of "managed liberalization", slowing down the opening of the market to entrants. The result has been a concentrated market structure with a few vertically integrated operators, fixed as well as mobile. The Electronic Communications Act of 2006 reformed the regulatory and licensing framework with little success as broadband uptake has been relatively poor and costs of ADSL and mobile HSDPA services remain high as a result of limited competition and ineffective regulation. In February 2005, the South African government published a new Convergence Bill, 2005, to provide a licensing and regulatory framework for a converged telecoms, broadcasting and information technology industry. However, it was not until mid-April 2006 that the Electronic Communications Act (ECA) was actually signed into law, and not until July 2006 that the ECA came into effect. Furthermore, key secondary legislation, such as that governing mobile number portability, was not activated until much later in 2006.

The latest response from the government is the creation of a fully state-owned broadband operator, which is also expected to address the high cost of international cable bandwidth currently provided exclusively by the incumbent. The potentially competitive benefits of market reform are not evident more than seven years after the official end to Telkom's monopoly. Its persistent dominance of the market continues to constrain the competitive services segment of the market and access and usage at the retail level. Telkom's unrivalled dominance in the wholesale sector has been regularly cited as a major factor behind the country's low teledensity and poor take-up of broadband services.

The South African mobile industry has been growing fueled by unmet demand for voice services and aggressive investment of industry players. Penetration rate reached 100% by 2009, which constitutes an excellent performance for a country with low levels of economic development and an important market concentration (see Figure C.11).

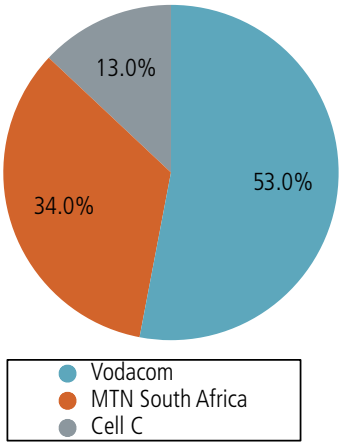
**Figure C.11. Wireless Penetration vs. GDP per Capita (2009)**




Sources: ITU; World Bank; TAS analysis

While the regulatory environment has not been conducive to investment in fixed network licensees in South Africa, global telecommunications companies see South Africa as the gateway into the rest of Africa, particularly in mobile. The future of the mobile industry will be driven both by attractive returns provided by mobile operators such as Vodacom and MTN and convergence within the telecommunications and broadcasting sectors (see Figure C.12).

**Figure C.12. South Africa: Mobile Industry Structure**




Source: Wireless Intelligence

Relative to MTN, Vodacom has significantly increased its investment and has been at the forefront of technological innovation in the South African market. This explains to a large degree the significant growth in subscriber numbers, which is expected to reach 100% during 2010.

Mobile data has been growing over the past five years, partly driven by the market migration to 3G based services. Demand for mobile data services is growing in South Africa, with mobile broadband seen as a solution which could boost the country's underperforming broadband industry as a whole. The introduction of 10 to 12 new undersea cables will surely see a growth in the industry.

The South African mobile industry benefits from 3G services offered by two leading network operators, Vodacom and MTN, both of which have international presence. These companies have been deploying multimedia content services, providing opportunities for content providers. Despite having fallen in 2009, ARPU levels continued to rise throughout 2008. However, South Africa's telecoms regulator, ICASA, appears to be ineffective in liberalizing the market. Moreover, the mobile market leader experienced negative growth for the quarter, with its customer numbers being adversely affected by the introduction of compulsory SIM registration on July 2009.

## D. Economic Impact of Broadband

In a prior paper, we presented a simple regression model linking Latin American broadband penetration and economic development (Katz, 2009). In this case, we have attempted to advance the research by developing a multi-variate equation based on the endogenous growth model (Barro, 1991) used by several authors to assess the impact of broadband and other telecommunications technologies on a country's economic growth (Qiang et al, 2009; Crandall et al, 2007; Garbaz et al., 2008).

Given the lack of available time series data regarding broadband penetration in Latin American countries[19], we chose to conduct a cross-sectional analysis with data for the period 2004-2008, relying on OLS with robust errors. Two problems needed to be addressed with this type of analysis. The first problem refers to the fact that the constant does not capture the potential differences among countries in terms of specific factors. One possible solution is to rely on panel data, which would allow controlling for the country idiosyncratic factors. However, the limited availability of data prevented us from relying on this approach. However, by including the technology factor (e.g. broadband), we reduced the problems linked to the omitted variables.

The second problem has to do with the endogeneity between GDP per capita and broadband penetration. Ideally, we would have liked to tackle this problem by relying on an approach similar to Koutrompis (2009), who implemented a simultaneous equations model that endogeneizes the decision to deploy broadband as a function of GDP per capita, pricing, competition and regulation. However, given the lack of time series data on pricing and competition for Latin American countries, it was impossible to rely on this approach. In this case, to control for this problem, we relied on the lag of the broadband penetration variable.

The following variables were used (see Figure 2):

**Figure 2. Variables utilized to measure broadband impact on economic growth**

| Type of variable | Data set | Source | Rationale |
|---|---|---|---|
| Economic growth | GDP (2004-8) | World Bank | Dependent variable |
| Control for level of development | GDP per capita (2000) | World Bank | Measure for starting point of growth |
| Control for Investment | Investment/GDP (2004-8) | World Bank | Measure for differences in investment levels |
| Control for Human Capital | Tertiary education (2002) | Unesco, Earthtrends, University of West Indies, Euromonitor, Government of the Commonwealth of Dominica | Measure for differences in human capital |
| Broadband penetration growth | Broadband penetration growth (2003-4) | ITU | Independent variable |

[19] We have broadband penetration data for the majority of Latin American and Caribbean countries after 2003 (19 countries included in the sample).

The results were as follows:

**Figure 3. Broadband impact on economic growth in Latin America**

| GDP growth | Coefficient | Standard error | T-statistic | P>[t] | 95% Conf. interval |
|---|---|---|---|---|---|
| GDP per capita 2000 | -.0006045 | .0002142 | -2.82 | 0.011 | -.0010528 |
| Investment/GDP | -.0006496 | .108927 | -0.01 | 0.995 | -.2286365 |
| Tertiary education level | .1900042 | .0670932 | 2.83 | 0.011 | .0495766 |
| Broadband penetration | .0177989 | .0061606 | 2.89 | 0.009 | .0049046 |
| Constant | 7.989611 | 4.063328 | 1.97 | 0.064 | -.5150321 |

| Number of observations | 24 |
|---|---|
| F(4,14) | 14.34 |
| Prob>F | 0.0000 |
| R2 | 0.4311 |
| Root MSE | 4.7802 |

As the results indicate, when controlling for educational level and starting point of development, 1% increase in broadband penetration yields 0.0178 point contribution to GDP growth. With this result, we proceeded to estimate the contribution of broadband to GDP growth. According to the IMF projection, the economic growth of Latin America and the Caribbean will be 3.4% between 2009 and 2010, resulting in a total GDP of US 3,925 billion. Our model estimates that the elasticity of broadband with respect to GDP growth is 0.0178% for a period without economic crises (2004-8). Assuming the possibility of sample bias (and given the lack of time series), we consider also the elasticity estimated by Koutrompis (2009) for countries with broadband penetration lower than 20%: 0.008%. Relying on the two extremes of the range, broadband growth between 2007 and 2008 (prorated average of 37%) contributed between US $6.7 billion and US $14.3 billion. This impact includes direct effects (in the telecommunications industry) and indirect (spillover), including not only the incremental impact but also the preservation of an economic growth rate.

Data set utilized for model specification:

| Countrycode | GDP per capita | Investment | GrowthGDP | Education | BBpen |
|---|---|---|---|---|---|
| ATG | | 66.2797 | 8.9403 | | |
| ARG | 7702.89 | 20.6923 | 16.5867 | 61.1355 | 107.823 |
| ABW | 20502.1 | | | 28.2821 | 387.313 |
| BHS | 16506.7 | 29.3046 | 4.3506 | 24 | 15.5457 |
| BRB | 10168 | 20.1008 | 5.5318 | 37.2433 | 8.1841 |
| BLZ | 3329.86 | 18.6054 | 5.521 | 1.93629 | 194.065 |
| BOL | 1009.76 | 13.5399 | 14.8069 | 38.2594 | 49.0383 |
| BRA | 3701.47 | 16.7093 | 18.9152 | 20.1332 | 222.64 |
| CYM | | | | 18.8224 | |
| CHL | 4880.05 | 21.0708 | 12.0877 | 41.0088 | 34.5049 |
| COL | 2364.27 | 23.1895 | 19.9581 | 24.0214 | 94.2288 |
| CRI | 4058.86 | 20.4167 | 9.9618 | 18.9653 | 84.3765 |
| CUB | | | | 27.8023 | |
| DMA | 3802.05 | 27.4794 | 5.0248 | 10.72 | 22.9353 |
| DOM | 2744.36 | 17.1358 | 16.2107 | 34.0052 | 144.656 |
| ECU | 1295.48 | 21.5539 | 11.6646 | 26 | 66.1192 |
| SLV | 2209.16 | 16.5201 | 9.8179 | 17.4876 | 49.0833 |
| GRD | 4078.75 | 50.4495 | 8.4024 | 4.5791246 | |
| GTM | 1717.86 | 19.3484 | 10.2256 | 9.51231 | |
| GUY | 942.36 | 24.7934 | 8.0225 | 6.51219 | |
| HTI | 448.932 | 28.3518 | 13.1886 | 1 | |
| HND | 1146.87 | 27.2208 | 9.8352 | 17.259 | |
| JAM | 3479.06 | | 10.1887 | 19.1449 | 197.798 |
| MEX | 5934.98 | 20.3829 | 7.4992 | 21.7426 | 144.245 |
| ANT | | | | 21.242 | |
| NIC | 770.589 | 27.4293 | 7.3006 | 17.8016 | 12.1392 |
| PAN | 3939.22 | 18.8851 | 10.2418 | 42.6653 | 9.3827 |
| PRY | 1322.65 | 18.666 | 18.1138 | 25.9625 | 498.308 |
| PER | 2049.3 | 20.1453 | 12.8428 | 31.9533 | 139.23 |
| PRI | 16003.7 | | | | 58.0852 |
| KNA | 7441.03 | 44.0985 | 6.5369 | 2.1776316 | 117.188 |
| LCA | 4224.21 | 25.2008 | 5.4352 | 12.8799 | 168.86 |
| VCT | 3102.43 | 32.4618 | 7.6686 | 5.665548 | 14.9604 |
| SUR | 1909.75 | 23.4107 | 21.8914 | 12.4278 | 91.9079 |
| TTO | 6269.92 | 16.7421 | 14.3111 | 8.36397 | 377.199 |
| URY | 6914.36 | 16.2452 | 19.4821 | 35 | |
| VEN | 4818.71 | 19.8794 | 23.2786 | 37.8436 | 76.5741 |

## E. Economic impact model assumptions

| | Mexico | Malaysia | Brazil | Bangladesh | South Africa |
|---|---|---|---|---|---|
| GDP (2009) (billion) | 1,143 | 212 | 1,623 | 82 | 276 |
| Estimated GDP growth (2010-2014) | 3.5% | 3.8% | 4.5% | 7.2% | 3.5% |
| Population (2009) | 110.6 | 27.5 | 192.3 | 159.2 | 49.3 |
| Population growth (2010-2014) | 1.0% | 1.9% | 1.2% | 2.0% | 1.0% |
| Handset price (2009) | 155 | 165 | 251 | 172 | 171 |
| Cost of services (annual, 2009) | 285 | 229 | 471 | 198 | 249 |
| TCO (2009, including taxes) | 347 | 295 | 571 | 267 | 301 |
| Taxes on TCO | 16.0% | 6.1% | 43.3% | 54.8% | 14.9% |
| Mobile broadband penetration (2009) | 2.9% | 13.1% | 3.1% | 0% | 8.0% |
| Mobile broadband penetration (2014) (base case) | 10.0% | 30.4% | 12.0% | 4.1% (see note) | 22.4% |
| Mobile broadband users (2009, millions) | 3.2 | 3.6 | 5.9 | 0 | 4.0 |
| Mobile broadband users (2014, millions) (base case) | 11.6 | 9.2 | 24.8 | 7.1 (see note) | 11.6 |
| Estimated average growth of mobile broadband (2009-2014) | 29.5% | 20.6% | 33.3% | * | 23.4% |

Notes:

1. There is no fixed date for the launch of 3G services in Bangladesh. The model estimates the impact in Bangladesh assuming a 5 year period after services are first offered, basing the calculations on the macroeconomic numbers of the period 2009-2014. The longer the launch is delayed, the higher the impact will be, as most likely GDP will be higher on year 0 and prices will be lower than the ones assumed in this exercise. To avoid additional assumptions, the decrease in handset price was assumed to be similar than in the rest of the countries studied. Conservatively, it was assumed that the cost of service did not decrease in the 5 year period, though its initial level was only 50% of the lowest cost of service assumed for other countries, reflecting current average prices (in nominal terms, as opposed to estimating PPP).
2. GDP is expressed in nominal USD billion. Price of handset, cost of service and TCO in is USD calculated at 2009 average exchange rates.
3. Prices of handsets were assumed to decrease 5.9% per year in all cases.
4. The cost of service was assumed to decrease each year by 4.3%, 8.9%, 9.7%, 0%, and 7.3% in Mexico, Malaysia, Brazil, Bangladesh (see Note 1), and South Africa respectively.
5. "TCO" (Total cost of ownership) is the sum of the cost of the annual service plus the amortization of the handset cost over a certain period. It was assumed it was amortized on average over a 26.8 month period in all cases (30 months in 2009). TCO includes taxes levied on services and handsets.
6. "Taxes on TCO" is the average taxes paid on services and on the amortization of the handset. For Brazil, which charges taxes on overall revenue, the "Taxes on TCO" was calculated in such a way as to make this percentage comparable to the rest of the case studies. In Brazil, certain other levies (FUST, FUNDTEL, and others) were not considered.
7. Mobile broadband penetration (2014) (base case) is the forecast assuming no changes in taxation. The estimation was based on existing forecasts (Telegeography, Wireless Intelligence, Pyramid, government reports, others) and were adjusted with adoption trends for fixed broadband and basic wireless penetrations observed in those countries in the past.
8. Monthly churn was assumed to be 3% in all cases. It was assumed that one third of these cases implied a handset replacement.

### Disclaimer on the assumptions and the methodology

It is important to emphasize that the methodology assumes a base case (described above) and the impact that a change of prices derived from a change in the taxation would bring over this base case. As such, the results are reasonably resilient to the assumptions on the base case. This claim is supported by sensitivity analyses that were carried out in all cases, of which an example is provided below.

To illustrate this point, different 2014 penetration scenarios are described in the case of South Africa. The analysis assumed that the penetration of mobile broadband users in South Africa would reach 22.4% by 2014. A sensitivity analysis was carried out assuming that this penetration would reach, by 2014, on the one hand, an additional point of penetration (23.4%, implying a user base 4.5% larger), and on the other hand, 10 additional points of penetration (32.4%, implying a user base 44.6% larger).

| | Base case | 1 p.p. of additional penetration in 2014 | 10 p.p. of additional penetration in 2014 |
|---|---|---|---|
| Penetration (2009) | 8.0% | 8.0% | 8.0% |
| Penetration (2014) | 22.4% | 23.4% | 32.4% |
| Users (2009) | 4.0 | 4.0 | 4.0 |
| Users (2014) | 11.6 | 12.1 | 16.8 |
| **Most conservative scenario (penetration elasticity: 0.6, GDP elasticity: 0.17)** | | | |
| Additional GDP | 138 | 139 | 148 |
| Additional tax revenue | (37) | (39) | (53) |
| Accumulated return | 1.87 | 1.84 | 1.60 |
| Additional users | 0.307 | 0.320 | 0.443 |
| Additional penetration (p.p.) | 0.591 | 0.617 | 0.855 |
| **Most aggressive scenario (penetration elasticity: 1.2; GDP elasticity: 1.38)** | | | |
| Additional GDP | 1,342 | 1,387 | 1,787 |
| Additional tax revenue | 303 | 314 | 409 |
| Accumulated return | 24.9 | 25.2 | 27.1 |
| Additional users | 0.620 | 0.646 | 0.895 |
| Additional penetration (p.p.) | 1.195 | 1.247 | 1.727 |

It can be observed that assuming an additional percentage point of penetration by 2014 renders only 1 MM USD (+0.7%) of additional GDP by 2014 in the most conservative case and 45 MM USD (+3.4%) in the most aggressive, with additional penetration ranging from 0.026 p.p. 0.052 p.p. (0.320 to 0.646 million additional users instead of 0.307).

Similarly, assuming that penetration by 2014 is 10 p.p. higher (a user base 44.6% larger), additional GDP is 10 (7.2%) to 532 (33.2%) MM USD higher on the most conservative and most aggressive scenarios respectively. The additional penetration over the assumed base was estimated to be only 0.26 to 0.53 p.p. (0.646 to 0.895 million additional users instead of 0.620).

Similar results were obtained for the other countries object of this report. Thus, as the model is based in estimating differences, the estimated impacts of lowering taxation depend less on penetration assumptions than on the actual level of penetration which each market studied will reach by the end of 2014. The model is based on estimating the impact of a lower tax rate on mobile penetration, on GDP, and on tax revenues. Thus, the forecast on which the impact estimation is calculated does not significantly determine the conclusion. The critical estimation is the difference between the penetration in the context of a lower tax rate and that of the status quo.

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