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Taxing Telecommunications in Developing Countries

by Thornton Matheson and Patrick Petit

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Taxing Telecommunications in Developing Countries

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Abstract

Developing countries apply numerous sector-specific taxes to telecommunications, whose buoyant revenues and formal enterprises provide a convenient "tax handle". This paper explores whether there is an economic rationale for sector-specific taxes on telecommunications and, if so, what form they should take to balance the competing goals of promoting connectivity and mobilizing revenues. A survey of the literature finds that limited telecoms competition likely creates rents that could efficiently be taxed. We propose a "pecking order" of sector-specific taxes that could be levied in addition to standard income and value-added taxes, based on capturing rents and minimizing distortions. Taxes that target possible economic rents or profits are preferable, but their administrative challenges may necessitate reliance on service excises at the cost of higher consumer prices and lower connectivity. Taxes on capital inputs and consumer access, which distort production and restrict network access, should be avoided; so should tax incentives, which are not needed to attract foreign capital to tap a local market.

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I. INTRODUCTION

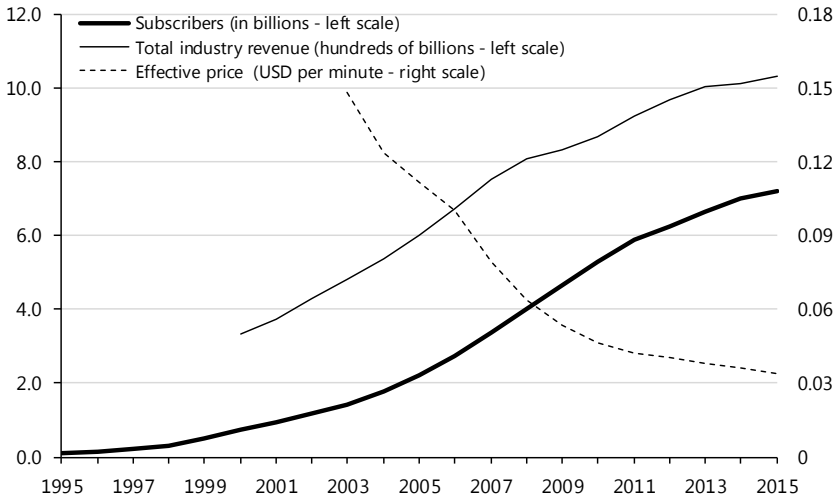
Governments have conflicting objectives regarding the tax treatment of the cellular telecommunications ("telecom") industry. On the one hand, they know that telecom services are an important input into productivity and growth, in parts because of possible externality and social inclusion effects, as well as consumer welfare. They therefore want telecom companies to provide services as widely and cheaply as possible and to rapidly introduce new technologies. They may even provide tax incentives for certain inputs (such as capital equipment or handsets), build essential infrastructure, or provide subsidies to extend service to remote areas. Broad telecom coverage is also seen as a security and safety imperative in many countries, and telecoms increasingly deliver vital services such as banking, health and education.

On the other hand, governments – particularly in developing countries – also regard telecommunication companies as a good source of revenues, given their formal sector status[2] and large and growing turnover (Figure 1). Cell phone operators are among the most important taxpayers in many low- and middle-income countries. In Jamaica and Malawi—two countries with relatively heavy telecom-specific taxes—total telecoms revenues (including license and spectrum fees) averaged 1.8 percent and 1.3 percent of GDP, respectively, in 2013-2015. In Senegal, mobile phone companies accounted for 20 to 30 percent of corporate income tax between 2005 and 2009, while in Haiti, over a quarter of the country's sales tax (excluding customs) came from the telecoms sector in 2014. The tax burden on telecoms has moreover been increasing: Deloitte (2007 and 2015) reports that the average ratio of direct and indirect taxes on mobile telecommunications to the "total cost of mobile ownership" rose from 17.4 percent in 2007 to 20.1 percent in 2015.[3] This increasing burden has led the industry to complain of over-taxation and raised concerns among policy experts regarding negative growth effects.

[2] Given the size of investments, telecom companies register locally, and there are no tax issues regarding permanent establishment or tax status.

[3] The country sample differs between the two reports, however, rising from 101 countries in 2007 to 110 countries in 2015.

Figure 1. Worldwide Market and Revenue Growth, and Average Price per Minute



Source: World Development Indicators, GSMA.

The total tax burden on telecoms includes not only consumer, corporate, and trade taxes, but a variety of sector-specific taxes such as corporate income tax (CIT) or value-added tax (VAT) surcharges, service and handset excises, and elevated customs charges on capital equipment (Table 1).[4] In addition, there may also be substantial regulatory charges, notably spectrum and/or operator license fees.

Table 1. Telecommunications-specific Tax Provisions

Provision	Description	Selected Country Examples
CIT surcharge	Elevated CIT rate or CIT surcharge on telecoms operators	Cote d'Ivoire, Jamaica, Jordan, Tunisia, Yemen, Zambia
VAT surcharge	Elevated VAT rate on telecom products and/or services	Argentina, Brazil, Jamaica, Mauritania, Sudan
Excises		
Domestic calls	Specific or ad valorem charge on domestic call minutes	Albania, Bangaldesh, Dominican Republic, Ecuador, Greece, Jamaica, Kenya, Malawi, Nepal, Pakistan, Tanzania, Turkey, Uganda, Ukraine, Venezuela, Zambia
International calls	Specific or ad valorem charge on incoming international calls	Congo-Brazzaville, Gabon, Ghana, Jamaica, Malawi, Senegal
Handsets	Specific or ad valorem charge for domestic and imported handsets	Bangladesh, Botswana, Brazil, Ghana, Nigeria, Lesotho, Syria, Tunisia, Turkey
Connection fees	Specific or ad valorem charge for telephone connection or SIM card	India, Tanzania

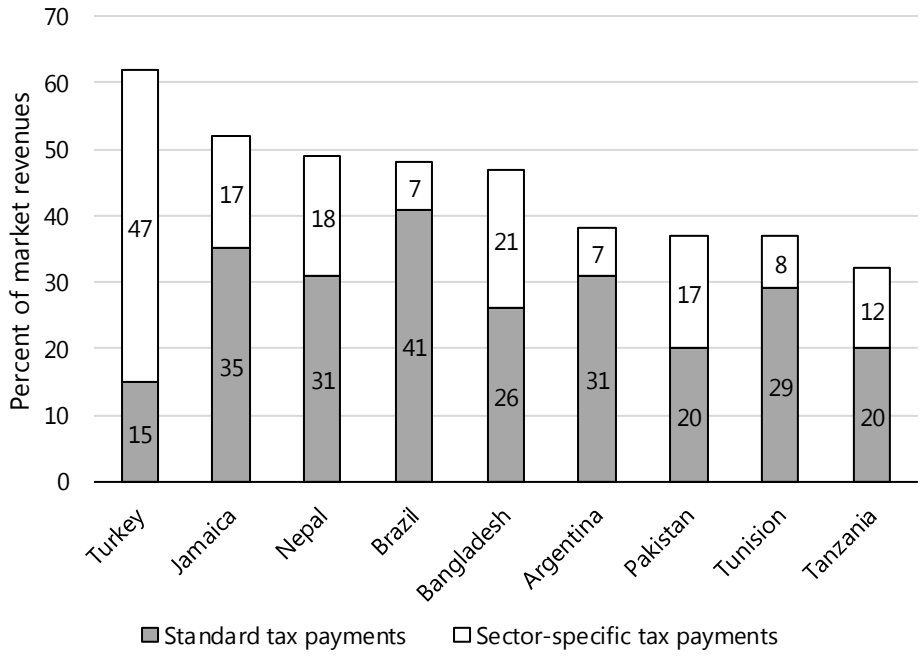
[4] A full inventory of the various tax regimes applied to the telecoms around the world is beyond the scope of this paper, given the number of taxes, fees and levies used in most countries. The interested reader can consult various industry-related publications in that regard (see for example Deloitte, 2012)

Elevated customs duties		
Operator equipment	Elevated customs duty on telecom producer equipment - e.g., cells, antennae	Argentina, Aruba, Azerbaijan, Bangladesh, Bermuda, Brazil, Cayman Islands, Dominican Republic, Turks and Caicos, Venezuela
Handsets	Elevated customs duty on imported handsets	Bhutan, Cameroon, Chad, Iran, Mozambique, Myanmar, Rwanda, Sri Lanka, Trinidad and Tobago
Tax incentives/ reduced tax rates	Reduced direct or indirect taxes on telecommunications companies or consumers	Angola, Congo-Brazzaville, Niger

Source: GSMA (2012), Deloitte (2016a, 2016b), dutycalculator.com.

Sector-specific taxes have indeed become as prevalent in the telecom industry (Figure 2) as in the extractive industries. In oil and mining, higher tax levels are justified by the presence of economic rents related to the exploitation of an inelastically supplied, non-renewable resource. A principal goal of this paper is to explore whether there are any similar conditions that justify the observed higher tax levels on telecommunications.

Figure 2. General and Sector-Specific Taxes in the Telecoms Industry



Source: Deloitte (2015).

The purpose of this paper is therefore to thoroughly review the tax burden on telecommunications to help developing country governments balance the competing goals of promulgating modern, affordable telecom services and ensuring adequate revenue. Its goal is to ascertain whether sector-specific taxation is appropriate, and if so identify the most appropriate and least distortive tax instruments to apply. The review focuses on the specific concerns of developing country governments, which generally have lower administrative capacity than developed countries and may therefore need to rely on taxes that are relatively easy to

administer. The best feasible approach to telecom taxation (and regulation) may therefore differ between developed and developing countries. Indeed, heavy sector-specific taxation of telecoms has been largely limited to developing countries, since developed countries can exploit to a much greater extent more efficient (but harder to administer) tax bases, such as the income tax.

This paper deals with the taxation of the telecommunication sector in general, but focuses on cellular telephony because it is by far the dominant form of communication in the developing world: In 2016, developed countries had 3.3 times as many cell phone subscriptions as fixed-lined subscriptions, while developing countries had 11.3 times as many.[5] Taxation of media content (e.g., e-banking and e-commerce) is not covered. Although governments influence telecoms provision through a variety of policies[6]—including regulation, state ownership and competition policy—a thorough consideration of all these policies is beyond the scope of this report, which examines only tax policy and spectrum auctions in detail.

This paper starts with a brief discussion of the special economic characteristics of the telecom industry that may justify special tax treatment. These include network externalities, growth effects, demand elasticity, industrial organization, and technological and regulatory considerations. The third section—the focus of this report—discusses the implications of the industry's characteristics for direct and indirect taxes applied to the telecoms sector. The conclusion provides some key lessons in designing and implementing a tax system that will help sustain sectoral growth while ensuring that telecommunications make a reasonable contribution to public revenues.

II. Economics of the Telecommunications Sector

A. Network Externalities

Telecommunications is a network industry in which new users generate positive externalities for existing users by broadening the network. Since the presence of positive or negative externalities can be an important reason for distinctive tax treatment of an industry or product, it is important to evaluate this aspect of cell phone use.

The value of a communication network lies in its ability to provide access to its members (Economides, 1996). Network expansion therefore provides a free benefit to those already in the network: Although individuals decide to buy and use a cell phone based on their perception of the existing network's value, each decision to join benefits all existing users. This positive externality suggests that free markets could yield a sub-optimal level of cell phone communications, since the marginal user takes account only of its own benefits, but not of those on others. This might indicate that a subsidy (e.g., for handsets) that lowers the cost of joining a

[5] International Telecommunications Union, http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

[6] Symeou (2011) provides a review of the literature on the impact of various state policies on telecommunications sector efficiency.

(continued)

network would be efficient.[7] This is especially likely to be the case when networks are first being established, when the externalities from their expansion will be large relative to the private benefits of joining. This is borne out by the common practice of cross-subsidizing network expansion to remote areas with revenues from established markets.

Evidence on the presence of network effects in the mobile sector is strong. For example, Doganoglu and Grzybowski (2007), estimating a demand model for Germany, conclude that the 700 percent expansion of cell phone communications over 1998-2003 was largely due to network effects (measured by lagged network size), and less so to the 41 percent price decrease.[8] Grajek (2010) reaches similar conclusions regarding Poland (1996-2001), finding that intra-operator network effects count most.[9] Other authors, such as Wu and Chu (2009) and Rouvinen (2006), rely on diffusion models[10] and conclude that both network effects (existing penetration) and potential user base have a significant impact on diffusion.

Despite strong growth in recent years, data suggests that cell phone access is still suboptimal in some areas. The ratio of global phone subscriptions (both fixed and mobile) to population exceeds 100 percent (107 percent in developing countries and 165 percent in developed countries). However, *unique* mobile phone subscribers as a percentage of global population (i.e., counting multiple phones for the same person as a single subscription) is only 67 percent worldwide—62 percent in developing countries (Figure 3).[11] Given the increasing importance of cell phones and the internet to accessing basic public and private services, full coverage for adult subscribers is arguably desirable. It should therefore be expected that public policy will thus continue to support network expansion to underserved areas through such policies as "buildout requirements" in telecom license agreements. Universal service funds, which are typically financed with charges on telecom activities, are sometimes also authorized for this purpose; however, they are prone to governance problems and the funds are often under- or mis-utilized.

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[7] A second type of externality may occur in "caller pays" pricing system, as the call receiver will benefit from incoming calls without incurring any usage cost (beyond the phone itself and the SIM card). This "call externality" will not be discussed here, as it relates to the more complicated issue of the impact of pricing system on use. However, it is important to note that taxes on outgoing calls will decrease this externality to the extent that it reduces calls.

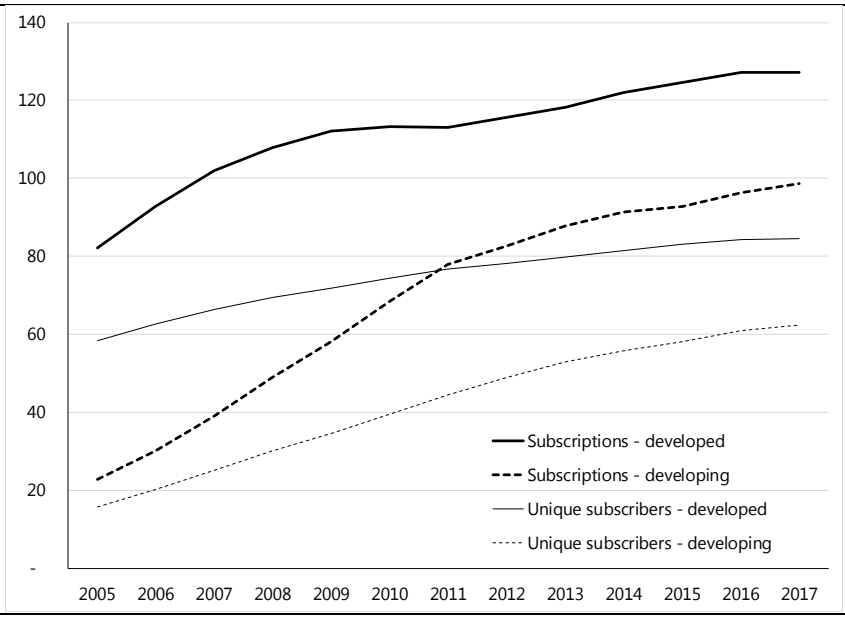
[8] Measuring a network effect requires measuring the externality to existing network participants from a new member. If lagged network size (and more accurately lagged absolute growth in number users) is taken as a proxy for future growth, then the effect measured by Doganoglu and Grzybowski (2007) is associated with the expected benefits from future network externalities.

[9] Cell phone operators tend to charge lower rates on calls between customers within their own network. One reason for this is that calls to other operators' networks incur a connection charge imposed by the other operator for terminating calls on its network. This charge may be limited by the telecoms regulator to prevent anti-competitive behavior.

[10] These models calibrate a function that assesses the speed of penetration, with a series of covariates.

[11] ITU and GSMA databases. Data on fixed-line subscriptions per unique subscriber were not available.

Figure 3. Global Cell Phone Penetration Rates
(Subscription per 100 habitants)



Source: International Telecommunications Union and GSMA

B. Contribution to Economic Growth

Information is essential to the function of any market economy and has been intimately associated with positive economic externalities. By decreasing the cost of acquiring information, cell phones reduce transaction costs, creating opportunities for additional transactions, and therefore contribute to economic efficiency and growth. In this respect, tax measures that decrease or slow down cell phone penetration could bring short term revenue benefits for the government at the expense of long term benefits for all.

There is a vast literature on the relationship between general information technology and growth, but a relatively small subset deals specifically with cell phone use.[12] Macroeconomic studies generally rely on cross-country panel data to assess the relationship between cell phone use and growth.[13] These studies rely on a host of cell phone use measures and explanatory factors, which can make comparing results challenging. Microeconomic studies document specific examples of improved efficiency, often at the village or community level.

Measuring the macroeconomic impact of telecoms is difficult due to the bidirectional causality between cell phone usage and growth. Following the pioneering work of Hardy (1980) on the

[12] For a review of the literature on mobile telecommunications, see Donner, 2008; Aker and Mbiti, 2010; Lam and Shiu, 2010; Andrianaivo and Kpodar, 2012; Pradhan, et al., 2014; and Kumar, Kumar and Patel, 2015, among others.

[13] Asongu (2015) offers a preliminary study on the relationship between cell phone use and income inequality.

(continued)

impact of fixed lines on growth, Cronin, et al. (1991) find that growth is driven by investments in telecoms, as well as the reverse.[14] Röller and Waverman (2001), working on fixed lines, address this causality problem using simultaneous equations, thus endogenizing telecom investments.[15] Finally, Waverman, Meschi and Fuss (2005) apply a similar model, as well as an endogenous growth model, to cell phone data, which ushered in a wave of studies on cell phones and growth.

The main conclusion of the macroeconomic literature has been that cell phones have a statistically significant and potentially large impact on growth; however, the magnitude of this effect varies widely depending on data, methods and study period. In a study of 92 countries over the 1980-2003 period, Waverman, Meschi and Fuss (2005) found that among low income countries, 10 more mobile phones per 100 people increased per capita GDP growth by 0.6 percentage points—roughly twice as much as in high income countries. Sridhar and Sridhar (2007) confirmed these findings for 63 developing countries over 1990-2001 (the early stage of mobile use in developing countries), and found that an increase of 1 percent in mobile penetration increased GDP by 0.01 percent; thus, the average cumulative growth in cell phone use of 248 percent increased GDP by 2.48 percent over the study period.[16]

The recent literature includes more data on low-income countries. Lee, Levendis and Gutierrez (2012) use 1975-2006 data from 44 sub-Saharan countries and find that cell phone penetration had a significant impact on growth recently (2000-2006) and that this impact is stronger where landline penetration is lowest. Using data on 44 African countries over 1988-2007, Andrianaivo and Kpodar (2012) find results consistent with Waverman, Meschi and Fuss (2005) that a 10-percentage point increase in the mobile penetration rate increases the growth rate by 0.6 percentage points. Interestingly, they also find that the price of a 3-minute conversation is negatively related to growth. Some of these studies also find that the impact on growth is stronger with higher penetration levels, which is consistent with network effects (see next section).[17]

Microeconomic studies regarding the benefits of mobile communication are reviewed by Duncombe (2016) and by Acker and Mbiti (2010), who point to 5 specific sources of enhanced welfare: (1) access to and use of information; (2) productive efficiency; (3) new jobs for mobile-related services; (4) reduced exposure to shocks and risk; and (5) delivery platform for key

[14] Lam and Shiu (2010) provide a more contrasting picture. Pradhan et al. (2014) provides an excellent overview of the causality literature, and find evidence of long run bidirectional causality for a broad measure of telecommunications (including landlines).

[15] Other approaches have been proposed to deal with the causality problem, although Röller and Waverman (2001)'s method has the advantage of providing an explicit demand equation for telecoms. See Datta and Agarwal (2004) and Lee, Levendis and Gutierrez (2012), for example.

[16] These findings are not that different from those of Waverman, Meschi and Fuss (2005) if we take into account what a percentage increase of 10 mobile phone per 100 people would represent at low penetration rates typical of the early 2000s.

[17] See Röller and Waverman (2001) for telecommunications, and Lee, Levendis and Guttierez (2012) for cell phones,

development services (e.g., financial, agricultural, educational). These factors are highlighted in a series of detailed case studies. For example: Jensen (2007) documents the reduced price dispersion, lower prices, higher profits, and the elimination of waste following the introduction of cell phones. Muto and Yamano (2009) find that the expansion of mobile phone networks is associated with greater market participation of remote producers of perishable goods. Acker (2010) finds that the introduction of cell phones in Niger between 2001 and 2006 lowered price dispersion by 10 to 16 percent on grain markets. Acker and Fafchamps (2015) measure a 6 percent reduction in producer price dispersion in Niger following the introduction of cell phones.

Research also shows a strong link between cell phone use and financial inclusion (e.g., Andrianaivo and Kpodar, 2012). However, the expansion of e-banking also depends on more than cell phone use (ADB, 2013): well-designed regulation, inter-operability of networks and related institutions, the presence of retail-level agents, etc. are some of the many building blocks of an effective e-banking system. In addition, it remains unclear how the current tax structures impact e-banking. For example, transfer of money through SMSs (as in the original M-PESA system in Kenya) in a system where excises apply only to voice communications should not have any impact at the margin. In this respect, more micro-evidence on the exact impact of tax levels and structures is needed.

The evidence, especially at the microeconomic level, generally suggests a positive causal relationship between cell phone use and growth, which tends to confirm that lower information costs improve economic efficiency. This does not, however, imply that there are externalities from telecoms, as transactions may be properly priced and all social costs and benefits thus internalized by the market. Thus, contribution to growth might not warrant special government intervention, although it might advocate against taxes that deter business (as distinct from consumer), and telecommunications in particular. This issue will be further discussed in the section on taxes (excise vs. VAT surcharge).

C. Demand Elasticity

Telecommunication excises on both services and handsets are sometimes justified on the ground that the demand for telecom services is inelastic, offering a good "tax handle". This section examines the empirical evidence regarding the own-price elasticity of telecom service demand. Discussion of whether demand inelasticity constitutes a sound rationale for excise taxation is postponed until the following section.

Empirical studies of the price elasticity of cellular communication find widely variant results across time and countries (Table 2). Thirteen early studies reviewed in Commerce Commission (2003) indeed found the demand for cell phone service to be inelastic: The own-price elasticity ranged from -0.06 to -0.54 for mobile subscription/network access, and from -0.09 to -0.8 for mobile originated calls.[18] By contrast, studies using more recent data including more developing countries show a wider range of estimates: Garbacz and Thompson (2007), examining panel data

[18] As discussed in Commerce Commission (2003), the distinction between mobile subscription/ network access fees (a one-off regular fee to access the network even without using it) and fees per call (the marginal cost of making a call) is not always straightforward and depends on the type of pricing and available data.

for 1996-2003 for 53 developing countries, conclude that though connection charges have little impact on penetration rates (price elasticity of -0.029 to -0.37), monthly prices have a stronger impact (price-elasticity of -0.195 to -1.268). The high end of that range of estimates is comparable to the -1.5 price elasticity that Waverman, Meschi, and Fuss (2005) find for a sample of developing countries over the years 1996-2003. Price elasticity estimates can also be found in several country-level studies for both developed and developing countries—for example, Caves (2011), Koutroumpis et al. (2011), and Hakim and Neaime (2014). Nevertheless, some country-level studies, such as Karacuka et al.'s 2011 analysis of the Turkish market, find inelastic demand in developing countries. Overall, the diversity of estimates for the elasticity of cell phone use remains a striking feature of this industry, although the price-elasticity of network access seems to be generally lower.

Table 2. Empirical Studies of Telecommunication Price Elasticities

Authors and country of study	Estimated price elasticity
Commerce Commission (2003): Review of 13 papers	Network access: -0.06 to -0.54 Mobile originated calls: -0.09 to -0.8
Waverman, Meschi and Fuss (2005): Aggregate production function for 38 low- and lower middle income-countries, including a demand for telecoms (penetration rate)	-1.5
Garbacz and Thompson (2007): Penetration data for 53 developing countries (1996 to 2003)	Connection charges: -0.37 to -0.029 Monthly price: -1.268 to -0.195
Dewenter and Haucap (2008): Austria traffic (01/1998 to 03/2002)	Short-term, businesses: -0.33 Short-term, private consumers: -0.14 Long term, businesses: -0.74 Long term, private consumers: -0.37
Gasmi et al. (2009): South Africa: sample of 6936 individuals in 2005	Between -3.8 and -1.3
Caves (2011): USA: traffic for 38 states (2001 to 2007)	-2.1
Koutroumpis et al. (2011): Greece: Quarterly traffic data (2005 to 2010)	-1.6
Hakim and Neaime (2014) (Middle East and North Africa: country-level traffic data (1995 to 2007)	Between –1.2 and -1.0
Karacuka et al. (2011): Turkey: operator data (01/2002 to 12/2006)	Short term, pre-paid: -0.20 Short term, post-paid: -0.36 Long term, pre-paid: -0.33 Long term, post-paid: -0.72

D. Technology, Industry Structure, and Market Power

The telecoms sector has evolved rapidly in recent decades, not only technologically but also in terms of its industrial organization and regulation. Until the 1980s, telephony depended on fixed-wire technology that required large-scale infrastructure investment. Like other network utilities (e.g., electricity and natural gas), telephone service was thus viewed as a "natural monopoly"—an industry with high fixed costs that creates increasing returns to scale such that the average cost of service provision is declining over the relevant demand range. Under these conditions, licensing two providers to establish two separate infrastructures would be inefficient; a single

provider could offer universal service at the lowest cost. Since a private telecoms monopoly would charge excessive prices, most countries organized telephone service provision as a state-owned monopoly; however, a few countries including the United States licensed private companies subject to government price regulation. In both cases, telephone service prices were aligned with the average cost of service provision: marginal cost plus a normal return to invested capital (Averch and Johnson, 1962).[19]

In recent decades, the telecoms sector has opened to greater competition due to both technological and organizational innovations. In the 1980s, governments began to liberalize telecommunication markets to reap the benefits of greater competition, such as increased efficiency, lower prices and innovation (Economides, 2004). Early market liberalization focused on privatization and unbundling of trunk-line ("back-hauling") connections and other services. The rapid spread of cellular phone networks in the 1990s introduced a major new source of competition for fixed-line telephony. Cellular phone penetration has been particularly strong in developing countries, where fixed-line networks initially covered a much smaller percentage of the population. The rise of the internet offers yet another form of competition for voice telephony: voice-over-internet-protocol (VoIP).[20] VoIP relies on internet data (as opposed to a voice signal) and can be delivered over telephone, cable and cellular networks, but it requires at least 3G technology. Thus, technological and organizational innovation have transformed telephony from a "natural monopoly" into a far more contested market.

Nonetheless, several factors still constrain competition in telecommunication markets, particularly in developing countries. First, though the fixed cost of establishing a cell phone network is lower than that of a fixed-line network, it is still quite substantial (GSMA, 2008). High entry costs thus continue to restrict telephone competition, particularly in more thinly populated or low-income areas where the return to investment is lower. In higher density areas, infrastructure duplication by competing cell phone providers suggests another means by which fixed costs could be lowered: Some governments are experimenting with decoupling physical infrastructure and user service provision for cellular communications, as they previously did for fixed-line communications.

Second, limited electromagnetic spectrum for the transmission of cellular communications constrains the number of potential service providers in any given market. The spectrum has numerous wavelengths, each with its own technical characteristics best suited to different types of transmission: Generally, higher frequencies have clearer reception but carry over a shorter range than lower frequencies. Given current technology, wavelengths in the 800-900 megahertz

[19] However, charges for different communication services did not in general reflect the specific cost of their provision: Typically, higher charges for long-distance calls cross-subsidized local connections, and high-density urban areas cross-subsidized low-density rural areas.

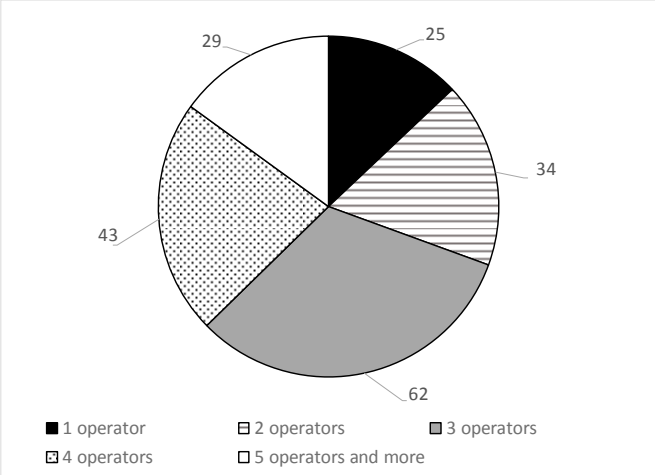
[20] Since VoIP requires a broadband (3G) connection, it is less widespread in lower-income countries, where affordability often limits access to 2G technology; however, in upper-income countries VoIP is making significant inroads into traditional telephony. VoIP services such as Skype and Whatsapp are generally refered to as "Over-the-top" or OTT providers.

(continued)

(MHz) range are best suited for cell phone communications, although frequencies as high as 2+ gigahertz (GHz) are sometimes used.[21] Limited spectrum availability requires that the spectrum authority can only license a few cell phone operators to serve a particular area. [22]

Together, these factors tend to limit cellular phone service provision to a small number of companies. Most countries have 2-4 providers, while some retain a monopoly structure, usually with at least partial state-ownership (Figure 4). Less than one fifth of countries have at least 5 providers—the level that Li and Lyons (2012) identify as the threshold for full effective competition. Limited competition facilitates implicit or explicit collusion among providers, leading to higher service prices than in a fully competitive market. Studying the telecoms industry in the OECD, Sung (2014) finds that industry concentration relates positively to both service prices and operator profitability, and Boniecki and others (2016) provide strong evidence of high industry profitability, which is positively related to industry concentration.

Figure 4. Number of Mobile Operators per Country



Source: GSMAintelligence.com.

Theoretically, limited competition is also likely to generate operator *rents*, or returns to investment in excess of the risk-adjusted market rate. For example, the standard Cournot model of oligopoly suggests that prices are a negative function of the number of operators; however, other models, such as Bertrand (1883), suggest that competitive prices could be reached with as little as two operators. Empirical research is needed to determine which model best describes the effective competition among telecoms providers in a given market.

[21] Other wavelengths are suitable for commercial radio transmission, remote control devices (for television, garage doors, etc.), satellite communications, GPSs, emergency vehicles communications (police, coast guards, etc.), and other communications instruments.

[22] Some countries (e.g., India) have allowed a large number of operators to use very narrow "slices" of the cell phone compatible spectrum. Although this policy increases competition, a major drawback is that each operator has very limited space to expand services.

Since rents exceed the rate of return necessary to induce telecommunication companies to invest and provide services, they can in theory be redistributed to consumers or the public treasury without undermining service provision. The existence of significant sectoral rents may thus provide a rationale for distinctive taxation of the telecommunications sector.

Major cellular operators' financial results confirm a relatively high level of profitability. For example, since 2009 the average return on assets of large US telecom service companies exceeded that of large-capitalization companies in general by 70 percent; telecom return on investment and return on equity were 16 percent and 15 percent higher than the market, respectively.[23] However, looking at individual markets, profitability varies significantly among operators depending on their market share. Analyzing telecom markets in the Middle East and Africa, Boniecki and others (2016) show that dominant operators have a ratio of earnings before interest, tax, depreciation and amortization to total revenue of 41-47 percent, vs. 30-37 percent for the second-largest operators and only 15-25 percent for the third and fourth operators.

As in the recent past, technological and/or organizational change may alter the competitive landscape for telecommunications, shifting the amount and locus of rents. A major trend in developed country markets, which is steadily trickling down to developing countries, is the shift from voice telephony to data-based communications (i.e., VoIP). Internet communications are usually channeled via local unlicensed spectrum (i.e., wifi) onto fixed-wire networks (DSL or cable), although data may also be carried over cellular broadband (3G+) networks.

The trend toward VoIP thus presents new competition for cellular operators that may erode cellular rents—or reallocate them to owners of fixed-wire and cable networks. This dynamic will vary by market, depending on consumer demand, industrial organization and regulation, and is an issue which requires further study. Internet service provision, which provides the link between data networks and end users, tends to be more competitive than cellular telephony, and therefore less likely to generate rents. Organizational innovations to extend the separation of infrastructure and end-user services - for example, the licensing of "virtual mobile network operators - may lead to greater effective competition among telecom providers, driving down prices and reducing rents for the entire sector. The extent to which new technologies and organizational forms augment effective competition and lower consumer prices of course depends in great part on regulatory and licensing policies.

E. Regulation

The magnitude of telecommunication rents depends integrally on regulatory policy, including spectrum licensing. Regulatory charges such as license fees increase operator costs, while price regulation, conversely, constrains revenues, both reducing profits. Regulations aimed at spurring competition, such as licensing additional operators, may also lead to lower service prices, also have the potential to reduce rents.

[23] Data on S&P 500 companies and the telecom service subsector obtained from csimarket.com.

Spectrum management policy determines the number of mobile telecom licenses in each market, with obvious implications for competition and profitability. In addition to limited spectrum and entry costs, market depth—a function of population size and density as well as income levels—is an important constraint on the number of operators that can feasibly be licensed in a given market. Examining 139 countries, Symeou (2011) finds that country size positively influences the number of operators as well as the efficiency of telecoms provision.

Not just the number of operators, but their relative market power is also important for effective competition. Even where multiple providers are licensed, telecom markets are often dominated by just one or two firms: the average market share of second providers is less than one third, while those of third and fourth providers are less than 20 percent and 10 percent, respectively.[24] The dominant firm is often the incumbent telecoms operator, which may still be partially or fully owned by the government. Providing for effective competition in telecom services may thus require restructuring of state-owned dominant firms and/or rebalancing of existing licenses.

Despite innovations that permit greater competition in the telecoms sector, price regulation may still be necessary in some markets. In many countries, the incumbent operator still controls key infrastructure assets, such as "trunk" telephone, cable or cellular networks. Unless access charges are limited, it could use this power to weaken its rivals. Further, every provider has a monopoly over connections to its own network, so regulation may be necessary to prevent companies from overcharging their competitors for connecting calls on their network.

Another cost that regulation may impose on telecom providers is service coverage extension to new areas, or "buildout". Regulators may set minimum buildout requirements in a license contract, or allow operators to bid on buildout levels as part of a license auction. Since buildout requirements usually extends service into more thinly populated areas, it usually reduces operator profitability. An alternative means of financing buildout is through a government "universal service fund" financed through fees or charges on telecom services.[25] Universal service fund charges also reduce profitability by reducing output and/or operator margins.

Regulatory agencies levy numerous charges on telecoms companies, including not only spectrum and license fees but also fees for public services such as industry monitoring (e.g., minute counts). Spectrum and license charges are usually quite substantial and have a significant impact on providers' profitability, while other regulatory fees are generally much smaller.

The function of telecoms regulation should be to ensure the widespread provision of good quality service at competitive prices, not to raise revenue. With the exception of spectrum licenses, which will be discussed in greater detail in the following section, regulatory charges should therefore be limited to the cost of providing the regulatory service. Charges that just cover service costs can be considered user fees, but any charge above (below) cost recovery is a tax (subsidy).

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[24] GSMAintelligence.com.

[25] There is some evidence that Universal service fund charges are often inefficiently deployed.

While tax revenues flow to the public treasury, license fees typically flow to telecoms regulators to finance their activities (although they may also be shared with the treasury). Ideally, all government bodies act as agents of the commonwealth, and thus the entity collecting various charges is irrelevant. In practice, however, there is likely to be divergence of interest among fiscal and regulatory bodies. Vesting taxing authority in both fiscal and regulatory interests may therefore result in their "overgrazing the commons" of the telecoms industry. Fiscal authority should therefore be concentrated in the treasury: telecoms regulatory agencies should have sufficient funds to carry out their important activities, but any residual revenue that they raise from spectrum licenses or other fees should flow to the treasury.

III. TAX POLICY

A. General Considerations

The main goal of modern tax systems is to finance critical public goods and services, including infrastructure, education and health care. Key criteria for assessing a tax system are its efficiency (i.e., minimum impact on economic behavior), equity (i.e., a tax burden proportional to or increasing with income), and simplicity (i.e., low administrative and compliance costs). Together, these criteria prescribe a system consisting of a few taxes with low rates that apply to wide, appropriately defined bases[26] uniformly across the entire economy.

While this prescription appears to preclude special tax treatment for any sector, certain economic factors may merit exceptions. One notable exception is industries that generate economic rents, which can in theory be efficiently taxed with no distortion to investment incentives. A salient example of this is extractive industries such as mining, which are often subject to special rent taxes as well as royalties. Another justification for differential taxation is the presence of externalities, where the private costs (or benefits) of some activity differ from the social costs (or benefits) of that activity, resulting in too much or too little of it. Activities with negative externalities, such as consumption of petroleum products (which cause pollution), should be taxed to bring their private cost in line with their social cost, while activities with positive externalities should be subsidized. Finally, it may be administratively infeasible to apply standard taxes to certain activities. A prime example of this is applying a credit-invoice VAT to margin-based financial services (such as bank loans and deposits). In these cases, a second-best feasible solution (such as VAT exemption) must be sought.

The previous section's discussion of the economics of cellular telecommunications suggests that the sector does have distinctive features that may warrant special tax treatment. Most notably, the existence of technological and regulatory barriers to entry, coupled with strong consumer demand that must be served by local infrastructure, may give rise to rents. Ideally, regulatory solutions to promote greater competition should be sought, but high fixed costs, limited

[26] Broad-based taxation implies subjecting a clearly defined base, such as labor income, capital income or final consumption, to uniform tax rates with few exemptions for specific activities. It does not mean that the tax base should be widened to include gross transaction values, as is the case for turnover taxes and transaction taxes, since these types of taxes cascade and cause distortions.

spectrum and regulatory capacity, and the small size of some developing country markets constrain this option. Since rents can be efficiently taxed without discouraging investment, some form of rent tax may therefore be appropriate. However, since telecom services are generally provided by multinational enterprises (MNEs), collection of profit-based taxes, such as CIT and rent taxes, may be difficult due to profit-shifting, particularly in countries with low administrative capacity. Simpler (albeit more distortive) revenue instruments, such as excises, may therefore be justified. As discussed in the previous section, positive externalities suggest that extension of the telecom network to unserved areas or populations should be (cross-) subsidized, and that taxes that specifically limit access should be avoided.

Public finance theory also posits that taxes on productive inputs should be avoided to prevent distortions in production efficiency that reduce output below the production possibility frontier (Diamond and Mirrlees, 1971). Revenue can be raised more efficiently with taxes imposed at the consumer level, which do not distort production. As a corollary, customs duties on capital equipment should ideally be zero.

The following sections review the various taxes that are or might be applied to the telecoms sector and assess them based on their capacity to capture rents without deterring investment or impeding consumer access.

B. Spectrum License Fees

Spectrum license fees (which in some countries are split into separate spectrum and operator license fees) are usually fixed payments levied up-front and/or periodically over the term of the license[27]. Once agreed, license fees form part of the operator's fixed cost structure, in addition to investment and overhead, etc. To incentivize investment, licenses must be long-term, with a typical duration of about 15 years.

Countries apply various methods for allocating spectrum licenses among potential providers (McMillan, 1995). Prior to the advent of cell phone technology, much of the spectrum was unlicensed and marginal values were low (if not zero). Licenses were thus often allocated on a first-come, first-served basis or by lottery. The spread of cell phone technology precipitated a sharp rise in demand for usable spectrum, and the resulting rise in its value required finding a more efficient means of allocation.

Since the 1990s, competitive auction has become the preferred means of license allocation in developed countries, although some countries set prices administratively based on various pricing algorithms (Bauer, 2003). Auctions ensure that licenses are allocated to the most efficient providers and procure public revenues. In theory, a bidder for a license would be willing to pay up to the amount by which the returns to the license exceed the cost of exploiting it (including a normal return to invested capital)—that is, up to the amount of the rents derived from holding the license (Cramton, 2002). The bidder with the lowest cost of provision and/or best ability to

[27] Some countries, however, deviate from this model: For example, in Hong Kong license fees are specified as a percentage of gross revenues, which operators bid over in the license auction.

maximize revenues would therefore have the highest valuation and should win the bidding, even if the winning bid does not fully reflect its expected rents. The extent to which the bid falls short of those rents will depend on various factors including the level of bidding competition and uncertainty regarding future profits.

Spectrum license auctions have yielded considerable government revenue, to the extent that cell phone companies have complained that spiraling license fees are undermining their investment in the sector and forcing them to raise prices. If fees set by auction constitute a tax on the pure economic rents arising from the limited supply of spectrum, however, they should neither deter investment nor affect output pricing (provided that they don't drive operators into insolvency[28]). Morris (2005), Kwerel (2000) and Bauer (2003) test this hypothesis and find no evidence that license fees have any impact on service pricing, which supports the theory that auctioned license fees indeed function like a rent tax. However, more recent work on auctions which take into account their effects on debt financing and post-auction competition show that auctions may indeed affect pricing and penetration rates. Janssen and Karamychev (2009) show that less risk-averse bidders are more likely to win auctions and to price their products higher post-auction. Haan and Toolsema (2011) show that, where bidders finance their bids through the debt market, debt levels may affect post-auction pricing. Studying 47 countries, Kuroda and del Pilar Baquero Forero (2017) find that penetration rates are lower in countries that conduct auctions.

Seeking to maximize spectrum auction revenues can create perverse incentives for regulators in designing spectrum licenses. Hazlett, Munoz and Avanzini (2011) stress that the most important function of auctions should not be to raise revenue but to ensure that the most technically efficient providers receive licenses. Misplaced emphasis on revenue-raising gives regulators an incentive to limit the size and number of spectrum licenses to increase their value.[29] Since rents are maximized under a monopoly, seeking to maximize license fees is thus likely to result in reduced competition and higher service prices.

A prominent concern regarding the use of auctions to allocate spectrum in developing countries is the possibility of collusion among bidders. The number of large multinational telecoms operators competing for licenses globally is relatively small, and their repeated interaction across different markets increases the risk of collusion to suppress license prices. Developing country spectrum authorities that have held auctions often complain of a lack of bidding competition, which frequently causes them to fall back on pricing licenses by negotiation.

Another possible source of auction failure is faulty auction design, including excessive reserve values. The general trend in developing countries has been from undervaluation of licenses toward full or overvaluation. In many countries, early cellular licenses were awarded by "beauty contest" and granted to winner free of charge. This early undervaluation—in some cases accompanied by tax incentives—later led to aggressive taxation in some countries: When governments realized that telecom licenses were highly lucrative and concessions were therefore

[28] For a more detailed discussion of this case, see Bauer (2003).

[29] For a general discussion of the relationship between competition policy and revenue-raising in developing countries, see Auriol and Warlters (2005).

not necessary to attract investors, they imposed telecom excises or other charges ex-post to recoup the value of earlier concessions. Thus, in more recent years, developing countries began to impose significant fees for spectrum licenses—whether by auction or negotiation—as regulators' understanding of their market value increased. Pricing was in some cases sufficiently aggressive that auctions failed due to excessive reserve values.

Improving government capacity to value spectrum licenses accurately would clearly facilitate the design of a reasonable fiscal regime for the telecom sector. Valuation of telecom licenses is complex, depending not only on the amount of spectrum allocated and market size and depth, but also on the license's many terms.[30] These may include the types of services that licensees should provide, the technologies they should employ, price caps for certain services, build-out, or a government equity stake. Further, the licensee may or may not have the right to sell the license to a third party. The more flexible and fungible the license, the greater will be its value and the higher the license fees it will elicit. Multilateral collaboration on spectrum license databases and valuation tools could help ensure reasonable revenue recovery from spectrum license allocation.

Ex-ante fixed license fees place all financial risks on telecoms providers, who will accordingly shade downward their bids during acquisition.[31] To distribute risk more evenly between government and provider, license fees could also be set in ex-post terms, with providers remitting a certain share of profits or gross revenues to the government.[32] Kwon, Lee and Oh (2010), who compare ex-ante fixed fees with ex-post fees based on profit-sharing or "royalties" (gross revenue sharing—the method used in Hong Kong) favor royalties. Although royalties, unlike fixed fees and profit sharing, do raise consumer prices, they create better incentives for regulators to allocate more spectrum to telecoms (in order to enhance revenues) and for operators to increase investment (due to risk-sharing with the government).

C. Rent Taxes

Spectrum fees (whether auctioned or not) are not the only way to tax an economic rent. Resource rent taxes (RRTs), which are observed mostly in natural resource taxation (Daniel et al., 2012), tax profits above the "normal rate of return" for a given industry—the minimum return required to compensate investors. For example, if the normal rate of return on the capital market is 15 percent, an equity-financed investment of US$100 that yields a profit of US$25 generates a rent of US$10. The tax base of the CIT is the whole US$25, but the tax base of the RRT is only US$10. To the authors' knowledge, RRTs have not yet been applied to the telecom industry.

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[30] For an in-depth discussion of spectrum license valuations, see Prasad (2015), Bazelon and McHenry (2013), and Hazlett (2008).

[31] It could be argued that large, profitable telecom MNEs are better able to manage risk than some developing country governments. However, MNEs are likely to manage risk by reducing investment, resulting in higher prices and/or lower service quality.

[32] Profit and gross revenue sharing are fully analogous to CIT and service excises dealt with in the following sections.

(continued)

RRTs take many forms (Box 1), each with its own pros and cons. Calculation of rents is generally based on the same accounting elements as the CIT, with certain key differences: Under most RRTs, interest expense is disallowed, and investment is fully expensed rather than depreciated. To preserve the real value of investment expensing, losses are carried forward with interest against future revenues. For this reason, the revenue profile of an RRT is more back-loaded than that of a CIT, entailing higher public revenue risks. RRTs in extractive industries typically have statutory rates of 15-30 percent and are applied in addition to—not instead of—the standard CIT.[33]

Box 1. Rent Taxation Options*

Brown Tax or R-based cash flow tax. This is a pure rent tax in which the state acts as a passive investor, meeting its share of all net negative cash flows by direct cash payment at the same percentage as the tax rate, and taxing all net positive cash flows at the same rate. The tax only narrows the distribution of possible outcomes, but does not change the mean expected return—any tax paid is thus a tax on rent. Accounting and tax depreciation do not feature: All capital is immediately expensed, so that calculations are on cash flows. The Australian RSPT proposal of 2010 approximated this tax (Henry, and others 2010).

Resource rent tax. This replicates many features of the Brown tax, but instead of direct cash payments by the state, the investor receives an annual uplift on accumulated losses until these are recovered. The uplift rate should be set at the minimum required rate of return for the investor. To the extent that losses can be completely offset against profits (i.e., before the end of the project), the tax is neutral and, in principle, the uplift factor should come close to a risk-free interest rate. Again, the calculations use cash flows, not book or tax depreciation.

Variable income tax (VIT). This scheme uses the CIT base, but varies the rate of tax according to the ratio of profits to gross revenues. It developed first in the gold mining industry of South Africa, where the effective tax rate may be lower or higher than the standard CIT base. The variant modeled here permits only a higher rate. The VIT is relatively simple but may introduce distortions, particularly if a high rate of tax applies when a period of high accounting profit occurs early in the life of a project, before the required return has been earned, or rent generated.

Tax surcharge on cash flow. A simple adjustment to the tax base of accounting profit by adding back depreciation and interest, and deducting any capital expenditure in full, yields a base of net cash flow in the year. This, too, could form the base for a surcharge. Instead of permitting an annual uplift for losses carried forward, the rate could be set sufficiently low to imply such compensation, or a simple uplift (investment allowance) could be added to capital costs at the start. This surcharge is used in the U.K. sector of the North Sea as a CIT surcharge on petroleum projects (rate from 2011/12 is 32 percent, in addition to normal CIT). This too could distort by taxing early revenue, but the effect is likely to be small.

Allowance for Corporate Capital (ACC) surcharge scheme. Instead of converting the tax base to cash flow, the ACC permits an annual uplift on the balance of undepreciated capital assets on the books. Actual interest paid is not deductible – whereas both interest and dividends are deductible in the case of an allowance for corporate equity. The ACC, therefore, creates neutrality between debt and equity financing, and should make the investor indifferent as to the rate of tax depreciation (since faster depreciation diminishes the money amount of ACC deductible). Norway uses this scheme to tax rents from hydropower projects, with a rate of 30 percent added to the CIT rate (24 percent in 2017 and then 23 percent in 2018).

[33] Mintz (2017) notes that, where both an RRT and the standard CIT are applied, their interaction can interfere with the neutrality of the RRT with respect to investment decisions.

* See Boadway and Keen (2012) and Land (2012). Box 1 is largely based on Daniel, P., P. Harris, O, Luca, C. Nakhle Sierra Leone: Fiscal regimes for extractive industries – A preliminary review. Fiscal; Affairs Department, International Monetary Fund (not publicly available).

Because RRTs tax only rent and not the normal return to investment, they are less distortive than the CIT. Like well-structured spectrum auctions, they should have no impact on marginal investment, production or pricing, and should therefore not impede network access. Insofar as rent taxes increase the average tax rate on investment—that is, the ratio of total taxes paid to total pre-tax profits—they may nonetheless affect an operator's decision on whether to enter a certain market. Since provision of telecom services requires local incorporation and infrastructure investment, a heavier average tax burden may not deter entry but would nonetheless reduce valuation of spectrum licenses.

Rent taxes are arguably more equitable than spectrum auctions, since they are based on actual rents earned rather than expected future rents at the time of bidding. If an operator earned no rents (for example, due to greater than expected price competition or technological obsolescence), then its liability under a rent tax would be zero. And unlike weakly structured auctions, rent taxes are not subject to collusion. However, like the CIT, RRTs are vulnerable to accounting manipulation and aggressive transfer pricing schemes aimed at shifting profits to lower-tax jurisdictions. Designing and implementing a new tax also entails significant administrative costs that must be weighed against the potential revenue and efficiency gains from introducing a rent tax. Also, a rent tax is most easily introduced at the outset of an investment project, so like spectrum auctions it should ideally be timed in accordance with the licensing and investment cycle.

D. Corporate Income Tax

Several countries, including Jamaica, Côte-d'Ivoire, Jordan and Yemen, subject telecom companies to higher CIT rates. The typical rationale for this policy is that the sector is perceived to have above-normal profits, so a higher CIT rate is applied to capture a larger share of them. Like spectrum fees and rent taxes, the corporate income tax (CIT) taxes rents, so a CIT surcharge may be a reasonable instrument to capture telecom rents. In a short-run, static context, the CIT is unlikely to directly affect consumer pricing: If operators are maximizing profits, then no proportional tax levied on profits would cause them to alter their input/output behavior.

Unlike spectrum fees and rent taxes, however, the CIT taxes the normal return to capital, which raises the cost of capital and depresses investment.[34] Output is therefore likely to be lower under an elevated CIT rate, and prices correspondingly higher. Furthermore, Davidson and Martin (1985) demonstrate that higher CIT rates may augment oligopolistic collusion to raise prices by

[34] This is one factor that has motivated a secular decline in CIT rates since the 1980s.

(continued)

restricting output: A decrease in the net-of-tax corporate discount rate raises the cost of future retaliation for cheating, which makes more restrictive equilibria possible.[35]

Like imposition of a rent tax, imposing a CIT surcharge increases incentives for MNEs to shift profits across borders through more aggressive tax planning.[36] For example, in a meta study, Heckemeyer and Overesch (2013) find an average semi-elasticity of multinational corporate profits to the CIT rate of -0.8, i.e. a 1 percentage-point higher CIT rate will reduce reported profits of an affiliate of a foreign company by 0.8 percent. Another method of tax avoidance, where the CIT base includes capital gains (or a separate capital gains tax is imposed), is transferring telecom licenses indirectly through offshore mergers and acquisitions rather than direct sales.[37]

Spectrum auctions, rent taxes and CIT surcharges all have the potential to tax rents accruing to telecom operators, and each instrument has its own strengths and weaknesses. Spectrum auctions reflect expected rather than actual rents and are vulnerable to collusion. Rent taxes are likely the most efficient and equitable of the three instruments, but defer revenues to varying degrees. CIT surcharges are more distortive than rent taxes or spectrum fees; however, given that countries already have CITs in place, imposing a higher CIT rate on telecom companies may be administratively less costly than introducing a rent tax in addition to the standard CIT. Which instrument (or instruments) are best suited to a particular market depends on various factors, notably administrative capacity as well as the stage of the licensing and investment cycle.

E. Excises

An important weakness of spectrum fees, rent taxes and corporate income taxes is that, as noted above, their performance depends in part on administrative capacity. Furthermore, profit-based taxes on capital-intensive industries yield revenues with a lag due to large up-front deductions for depreciation or expensing. Many countries, especially in Sub-Saharan Africa, have therefore introduced telecom excises to ensure a significant, up-front revenue yield from the sector. The most important excises in revenue terms are on telephone services (purchased by both businesses and final consumers), but some countries also impose excises on handsets and initial connection (e.g., purchase of SIM cards).

Levying an excise on a particular good raises its price relative to other goods, thereby suppressing its consumption. This effect is less pronounced, the less the own-price elasticity of

[35] Building on this model, Liu and Altshuler (2013) find evidence that more concentrated industries in the U.S. are more successful than competitive industries at shifting corporate taxes onto labor by restricting output.

[36] There are several methods for doing this, including the payment of excessive royalties for firm-specific technology; the payment of excessive management or service fees; the over-invoicing for inputs through offshore cost centers (notably capital goods); and excessive leverage (thin capitalization) - see Schatan (2012).

[37] In the case of Vodafone, Indian cell phone license holder Hutchison avoided $2.6 billion in capital gains tax by selling its offshore subsidiary to Vodafone, rather than directly selling the license. See IMF et al. (2017).

(continued)

the excised good.[38] Even if the demand for a good is highly inelastic, however, taxing it more heavily than other goods distorts consumption due to cross-price elasticities. For this reason, excises are usually confined to goods that are not only price-inelastic, but also have negative externalities: e.g., alcohol, tobacco, and petroleum products. As shown in the previous section, telecom demand varies greatly across samples and is not always inelastic; moreover, telecom connectivity has positive rather than negative externalities. Telecom service thus does not conform with the standard requirements for an excisable good.

The remaining justification for telecom excises is that they provide a good "tax handle" on an industry than can otherwise be difficult to tax. As such, excises have the attractive property of being relatively easy to administer, making them especially important to countries with low administrative capacity. Telecom service excises function similarly to royalties in the extractive industries: Levied as a percentage of output value or fixed charge per unit, royalties are used – even in the presence of rent taxes and CIT – to raise revenue from the start of production. Because they tax gross revenues, rather than net income, royalties are much less vulnerable to tax evasion than CIT or rent taxes. However, they therefore run the risk of rendering marginal projects unprofitable and thus reducing investment and output (Daniel et al., 2012). Nonetheless, moderate royalties can play an important role as part of a balanced mix of tax instruments aimed at sharing fiscal and economic risks between government and investors.

The remainder of this section reviews the various types of telecom excises currently in use, considering their capacity to capture rent, their impact on externalities, and their administrability.

Excises on domestic calls

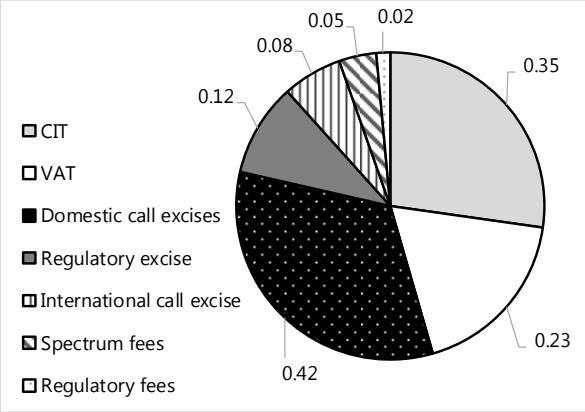
Most excise revenues from the telecom industry are from excises on domestic phone calls. In Malawi, for example, domestic excises account for almost half of total fiscal and regulatory revenues generated by the telecoms sector, which averaged 1.3 percent of GDP in 2013-2015 (Figure 5).[39] In Jamaica, telephone excises plus the VAT surcharge account for more than one third (Figure 6) of total telecom revenues, which averaged almost 1.8 percent of GDP in 2013-2015.[40]

[38] Hence the "inverse elasticity rule" prescribing that excises should relate inversely to goods' own-price elasticities.

[39] In Malawi, both the treasury and the telecoms regulator, MACRA, levy ad valorem excises on telephony. MACRA also levies a charge on international calls. Jamaica levies specific excises on domestic and international calls at different rates; excise data include revenues from both sources. Jamaica also levies a higher VAT rate of 25 percent on telecommunication services, vs. a standard VAT rate of 16.5 percent.

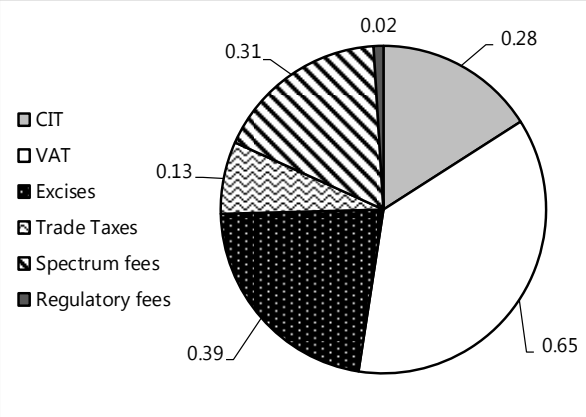
[40] The Jamaican VAT on telecom service is 25 percent, vs. the standard VAT rate of 16.5 percent. Therefore 34 percent of VAT revenue, or 0.22 percent of GDP, is due to the VAT surcharge.

Figure 5. Malawi Telecommunications Revenues (% of GDP)



Source: Authorities, IMF staff calculation.

Figure 6. Jamaica Telecommunications Revenues (% of GDP)



Source: Authorities, IMF staff calculation.

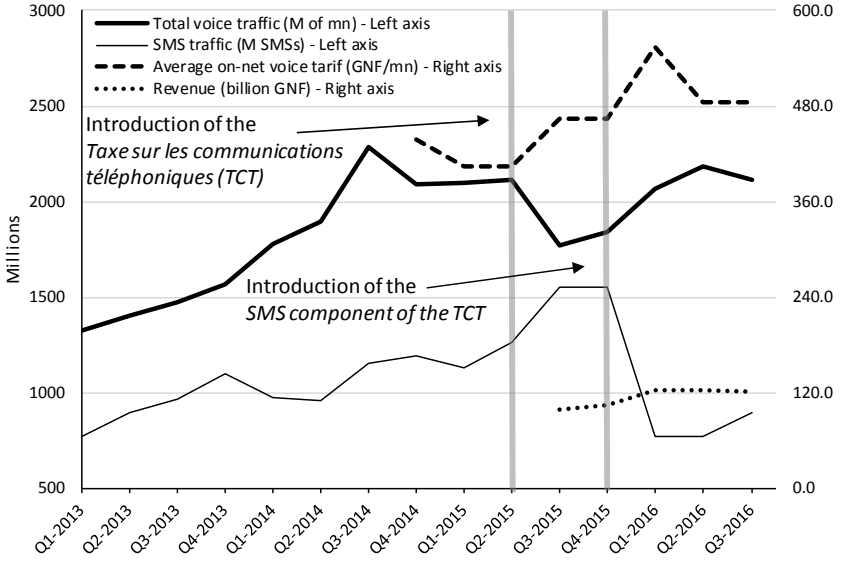
Telephony excises may be either specific (a fixed charge per minute) or ad valorem (a percentage of service charges). Since both types of excises are proportional to output and gross revenues, they should also be roughly proportional to profits[41]; however, the relationship between output and profits, which depend on costs as well as gross revenues, will generally vary considerably among products as well as operators. Excises are thus less effective than a CIT or rent tax at capturing a share of rents.

Unlike a rent tax or CIT, excises generally affect the price of the excised good. The extent to which an excise changes the price of the good depends on the relative price elasticities of supply and demand: The more elastic supply (demand), the more the burden of an excise will be borne by the consumer (producer). An excise would only fall entirely on producer rents in the unlikely case that telecommunications supply was completely inelastic. Although this might be the case in the short run, given existing infrastructure, over the medium-term disinvestment due to reduced profitability would reduce capacity and drive up consumer prices, shifting some of the burden back onto consumers.

In general, therefore, some part of the burden of telecom excises can be expected to fall on consumers through higher service prices and therefore result in lower traffic (Figure 7). In Guinea, for example, significant budget difficulties led to the adoption of 1 GNF per second tax (so 60 GNF per minute, or nearly 15 percent of the average price per minute) in 2015, which led to an immediate equivalent fall in traffic. While the upward growth path immediately resumed, this new path remained roughly 15 percent below the pre-tax trajectory (Figure 8). The impact of the SMS component of the same tax was even more dramatic.

[41] For a given level of service prices, both types of excise take a certain percentage of gross revenues; as prices change, however, an ad valorem excise will continue to take the same percentage, while the percentage taken by the specific excise will move inversely with prices.

Figure 7. Impact of A New Excise: The Case of Guinea*



Source: Agence de Régulation des Postes et Télécommunications.
* The tax amounts to 1 GNF per second, so 14.2 percent of the Q2-2015 average on-net voice tariff. Traffic decreased by 16.1 percent in Q3-2015. Quarterly revenue from the tax is roughly 12 M USD (exchange rate of 10,000 GNF/USD).

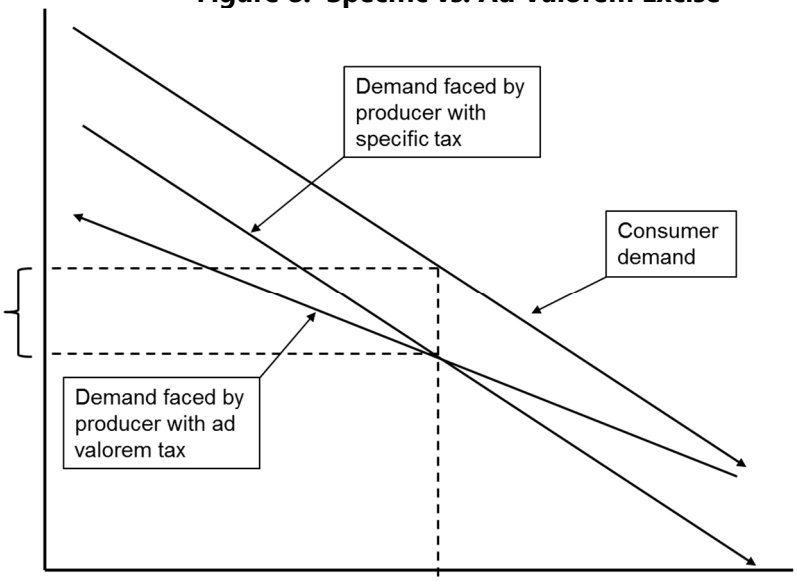
In contrast to a VAT surcharge (discussed in following section), excises increase telecom prices for both consumers and businesses. Taxes on business inputs distort production and lead to "casacading" when business outputs are subject to further taxes (such as VAT or sales tax). This aspect of telecom excises is of particular concern, as it may reduce productivity.

In countries that impose telephone excises, the resulting higher service prices have accelerated the trend toward VoIP. This illustrates the fact that excise taxation is less effective where substitution options increase tax base elasticity. In response, many countries have therefore extended the telecom excise base to include internet data in order to forestall base erosion (e.g., Turkey, Guinea). As noted previously, the impact of the trend to VoIP on telecom rents is unclear, but it may undermine sectoral rents and thus the justification for special sectoral taxes.

Where telecom competition is limited, service excises may increase the market power of the dominant firm—an effect often seen with high royalties in the extractive industries. Highly profitable dominant firms will better withstand imposition of a sizeable consumer excise than marginal (higher-cost) operators, who may be driven out of the market. Excessive consumer excises could thus serve to bolster the market power of dominant operators to the detriment of consumers. Excise taxes can also facilitate collusion among the providers, causing a greater contraction in output than the price increase alone would warrant, so that the excise is actually "overshifted" to the consumer. Higher corporate profits may increase CIT revenue somewhat, but at the cost of reduced excise revenue, productivity and welfare.

The literature on the effect of excises on prices in markets with limited competition[42] generally concludes that ad valorem excises dominate specific excises in terms of welfare effects. Under oligopoly, equilibrium prices will be lower under an ad valorem excise than under an equivalent specific excise. An ad valorem excise in effect flattens the effective demand curve that operators face, while a specific excise shifts the curve downward (Figure 8). Facing a more elastic effective demand curve nudges operators' behavior toward what it would be in a perfectly competitive market. With an ad valorem excise, part of the cost of a price cut is borne by the government in terms of lower tax revenues, so producers have more incentive to reduce prices. Further, if extension of the telephony excise to internet data becomes necessary, ad valorem excises are more straightforward to extend, since internet service has different consumption units than telephony (megabytes vs. calling minutes).

Figure 8. Specific vs. Ad Valorem Excise



Excises on international calls

In the last 15 years, pressing revenue needs have driven governments to tax international incoming calls, typically at rates that far exceed any domestic call excise. Governments like international call excises because they seem to fall on foreigners. In addition, it is often assumed that foreign operators will absorb the international call tax rather than pass it on to their own customers, so the tax will not reduce incoming traffic. High excises on international calls are particularly prevalent in sub-Saharan Africa, where at least 16 countries have imposed them, with significant short-term revenue benefits. For example, Burundi raised the rate of its termination

[42] See for example Delipalla and Keen (1992); Keen (1998); Hamilton (1999); Anderson, de Palma and Kreider (2001); Auerbach and Hines (2001); and Weyl and Fabinger (2013).

(continued)

fee to 247 percent of the underlying charge (GSMA, 2014).[43] In Jamaica, the excise on domestic calls is about US$0.003 per minute, while the rate on international calls is US$0.075 per minute.

High incoming call excises are a revival of once-common international "termination charges"—fees charged by the recipient's operator to the caller's operator to grant access to its client. (For a description of the international call termination process, see Box 2). Prior to the telecoms liberalization of the 1980s and 1990s, state monopolies running fixed-wire networks imposed high termination charges on incoming calls. These were dismantled during the ensuing liberalization by international organizations, led by the International Telecommunication Union (ITU) and the World Trade Organization (WTO), which pushed for global telecommunications integration.[44] As with trade tariffs, multilateral imposition of high termination charges or incoming call excises results in a general reduction of welfare.

Contrary to many governments' expectations, incoming call excises have a significant impact on traffic. Foreign operators do pass the costs on to their customers, and the base has proven to be quite elastic: For example, when Ghana and Gabon imposed taxes that raised incoming call prices by 58 and 82 percent, call volume dropped by 27 and 57 percent, respectively (GSMA, 2014; OECD, 2014).

Several technological innovations contribute to the elasticity of the international call tax base: Calling volume has shifted toward the internet using not only VoIP[45] but also illegal "SIM boxes." SIM boxes use local SIM cards to transform international internet-carried calls into local phone calls.[46] To counter the shift to VoIP to escape telephone call taxes—which also impacts domestic call volume and telephone excise revenue—many governments have broadened the base of telephone taxes to include internet services.

The political costs of termination charges have also become more apparent: The incoming call excise is likely to fall heavily on the country's own diaspora and business partners, and these powerful groups have launched vocal opposition that has in some cases prevailed. Some

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[43] The traffic subject to these charges is generally monitored by private engineering consulting firms which promote the tax as a business strategy and are usually paid a percentage of the revenue they collect—up to 50 percent in some cases.

[44] Since the WTO led negotiations on basic telecoms services in the 1998 Fourth Protocol to the General Agreement on Trade in Services, 108 WTO members have committed to facilitate trade in telecoms services. Of these, 82 members have committed to basing interconnection charges on "cost-oriented rates that are transparent [and] reasonable." Similarly, in 1997 the United States Federal Communications Commission (FCC) issued an order prohibiting US carriers from paying more for international termination charges than specific ceiling rates. The ITU's International Telecommunication Regulations (89 signatories) also contains language aimed at restraining international connection charges (OECD, 2014).

[45] As only broadband users can access VoIP, telephone call taxes are regressive since broadband use in developing countries remains unaffordable for most consumers.

[46] Although assessing the size of the illegal market is challenging, GSMA (2014) estimates that in Ghana, 10 percent of international calls were re-routed through SIM boxes. Authorities have consequently deployed sophisticated means to track SIM boxes and their owners.

governments have also become more concerned about the economic costs of high international call excises, including higher communication costs for regional calls and reduced CIT revenues and remittances. One result of these pressures has been the May 2014 agreement among Kenya, Rwanda, Burundi, Uganda, and South Sudan not to tax each other's outgoing calls.

Box 2: International Call Termination Process

Using a cellular phone in one country (e.g., France) to place a call to a cell phone user in another country (e.g., the Democratic Republic of the Congo) involves several steps. The caller's handset will first send a signal to the local tower of his operator company that is nearest to its current location (each tower is thus the center of a "cell"). That signal travels through the electromagnetic spectrum that was granted to that operator, and the call itself is assigned a specific channel within that spectrum, so that it does not interfere with other calls.

The tower then communicates either through the spectrum or through a land line with a switching point that directs the call onward. For a local call destined for a land line, the signal will remain in a landline, but if destined for another cell phone user it will go back to a tower and through the electromagnetic spectrum. For an international call, however, the call is transferred to a submarine fiber optic cable. In the case of a call from Paris to Kinshasa, it will travel through the Africa Coast to Europe, or "ACE" cable, which connects France and Portugal to the west shore of Africa, all the way to South Africa. This cable is owned by a consortium of partners (telecom operators, national governments, cable companies, etc.) led and managed by the French operator Orange. Once the call arrives in Congo, it is transferred back onto the cell phone network (possibly travelling through some land line segments) to reach the party called.

Taxes on international incoming calls are generally imposed through a minimum price to be charged for connecting ("terminating") the call to the end user's operator in the destination country. The tax is then remitted to the destination country government as a share of that minimum price.

Internet data can also travel through the ACE cable, but if it is not subject to the telecom excise, then the higher rate will not be imposed. If the call recipient is connected by wifi to a fixed phone line or cable, then the connection will terminate through a fixed-line network; but if the user is connected through a mobile device, the data will connect back through the cellular network. Thus, a VoIP call from Paris could reach a computer or smart phone in Kinshasa without being subjected to the tax on incoming calls. Alternatively, a data signal can be (illegally) connected back to the cell phone network in DRC through a SIM box, and terminated as a local call. In that case, it would be subject to the domestic phone call excise, but not the higher international call excise.

The attraction of using an international call excise to tax foreigners is clear, particularly for low-income countries, where incoming calls generally far outnumber outgoing calls.[47] Nonetheless, the distortive effects of very high excises should be avoided. Where service excises are levied on domestic users, it is difficult to argue that foreigners making incoming calls should not be subject to at least the same level of taxation. International call excises should therefore be limited to the same rate as domestic telephone excises. This would notably eliminate the incentive to use SIM boxes.

[47] The 1997 US Federal Communications Commission guidelines, which cap termination rate payments for US carriers, set higher ceiling rates for lower-income countries, implicitly recognizing that they have a stronger rationale for relying on this revenue source than wealthier countries, which have deeper domestic revenue capacity.

(continued)

Excises on Network Access

While service excises typically account for the bulk of telecom excise revenue, some countries also impose excises on the up-front costs of establishing phone service, including handsets and initial connection charges (e.g., SIM cards).[48] Compared to a service excise that raises the same amount of revenue over a longer period (even in present value terms), excises on phone acquisition and initial connection are particularly harmful. This is because they may altogether prevent access, especially in low-income countries, reducing the size and value of the telecom network for all users. Indeed, the presence of positive network externalities may indicate that initial access should be subsidized; however, subsidies, in addition to increasing revenue needs, are prone to abuse and should probably therefore be avoided. Nonetheless, tax policy should at least not increase the cost of network access. High excises (or customs duty) on small, portable items like cell phones can also promote smuggling. Finally, unlike service excises, taxes on handsets and initial connection seldom raise significant revenues, so for all the above reasons they should be eliminated.

F. Value-added Tax

Most countries appropriately apply a VAT to telephone services at the standard rate. However, several countries apply a higher VAT rate, for the same reasons that countries apply telephone excises. The arguments for and against doing this are thus the same as for excises, with one significant difference: Due to input VAT crediting, the VAT is not a cost for registered VAT payers, so the production distortion created by telecom excises is alleviated—at least for formal-sector companies above the VAT threshold. Informal companies, however, would still experience the higher VAT rate as a cost, although taxing these companies indirectly may be a deliberate policy goal. To raise the same amount of revenue from a VAT surcharge as from an excise, the surcharge would have to be higher to offset the cost of crediting for registered businesses, which would increase the price distortion for other users.

On the downside, a VAT surcharge could potentially complicate tax policy and administration. Dual VAT rates, once in place, may be difficult to contain to a single industry. For example, many countries introduce a reduced VAT rate on a few staple items to relieve poverty; these reduced rates have a tendency to creep to other goods and services as businesses selling directly to consumers (e.g., tourism) lobby to have their output taxed at the lower rate. Reduced VAT rates are an inefficient subsidy to the poor, and can greatly complicate VAT administration. The IMF has therefore consistently supported a single-rate VAT. Clearly, businesses would not lobby to broaden the base of a VAT surcharge, but there could nonetheless be political pressure to use it to increase revenues, ultimately leading to a multiple-rate VAT. Also, if telecom expenses were a large enough to generate excess VAT credits, refunds would be required, which are a weak point of VAT administration in many low- and middle-income countries.

[48] Handsets may also be subject to elevated customs charges.

As for any industry, implementing a VAT may require practical adaptations to local market conditions and institutions (Box 3). However, a more complex issue is to properly and consistently implement the VAT on international calls. If the base case (Box 3) is rather straightforward, within- or cross-country confusion or inconsistencies on the definition of the place of consumption may create significant departures from basic VAT principles (hence economic inefficiencies), double taxation, or no taxation at all.[49] Such difficulties may be compounded by other VAT-related goals, such as regional harmonization, hence at times the need for arbitrary rules, especially for complex transactions involving multiple countries.

Box 3. VAT Pre-Payment and Calling Cards

In many developing countries, cell phone operators often sell pre-paid calling cards (recharge) to bulk distributors, who in turn resell these cards to a network of small distributors (e.g., street vendors). Given the number of participants involved, collecting the VAT by the credit-invoice method all along the supply chain would entail daunting administrative difficulties. In addition, because the calling card carries a fixed nominal value, it needs to be sold at a discount compared to its face value for profits to be generated along the distribution chain.

These problems are often dealt with by applying the VAT on the nominal amount of the recharge and collecting it at the operator's level. The effective VAT rate on the operator/bulk distributor transaction will therefore be higher than the statutory rate. For example, a card sold to the final consumer for 1000 CFA Francs (FCFA) in Senegal will include an 18 percent VAT. The pre-VAT price will therefore be 1000/1.18 = 847.46 FCFA, and the VAT will be 152.54 FCFA. This means that the operator might sell the card for pre-VAT price of 750 FCFA to the bulk distributor, to which the VAT on the final retail price is added, for a total of 902.54 FCFA. The bulk distributor might then resell the card VAT-free to the street vendor for 960 FCFA, who then resells it to the final consumer for 1000 FCFA. It follows that the effective VAT rate on the first transaction is 152.54/750, i.e., 20.3 percent (which is of no consequence). The bulk distributor and street vendors do not collect any VAT and cannot claim any VAT credit.

[49] Some countries have for example applied the VAT to net international revenue (i.e., access fees charged to, minus access fees paid to foreign carriers), which amounts, based on Box 2, to applying the VAT to net exports. Given the net incoming traffic to most low-income countries, removing such practices has met with fierce resistance, given revenue implications.

Box 4. Prepaid cards, and international calls: who pays the VAT?

Generally, and in line with standard principles, VAT on telephone calls should apply at the point of consumption (destination principle – hence exports are zero-rated), and all VAT paid on inputs should be offset against VAT collected on sales, as per the credit-invoice method (except for non-registered entities – i.e., the final consumers). In practice, however, a conversation involves two individuals and potentially many operators, and payment systems may differ (e.g., caller pays vs. shared payment), and determining the point of consumption and VAT liability can be problematic, hence the need for a common agreement on the application of VAT for cellular communications. A common agreement, however, is not just an arbitrary decision, as it can have significant administrative implications. This notably led to the recent revisions of the EU Directive on the Value-added Tax* which now recommends that the country of origin of the calling SIM card be considered the place of consumption.

This norm echoes existing practice and has numerous implications in many low- and middle-income countries, where VAT-able prepaid card / "caller pays" system are in place, and where the treatment of the VAT between operators has often been the source of much disagreement between authorities and operators, especially regarding international calls. The table below summarizes the implications of this standard for the application of the VAT, depending on the type of call. The base case in which a local call is made between two local (Home) SIM cards is simple and the caller is liable for VAT (taken from his prepaid account by the operator and paid to the government upon completion of the call). Complications arise in other cases. When, for example, a "Home" SIM card calls from "Abroad" this call should in principle be subject to VAT in Abroad (i.e., where the call is "consumed"). However, this would require that the caller registers his SIM in Abroad to pay the VAT, or that the Home operator transfers the VAT to the Abroad operator (at the Abroad rate). Because of such administrative difficulties, assuming that a Home SIM card always calls from Home - wherever it is located - and hence determines the place of consumption greatly simplifies the VAT treatment. This, however, has a series of implications for the VAT treatment of various types of calls. The table below presents possible cases, depending on the origin of the SIM card and the location of the caller and receiver, and provides the VAT treatment of inter-operator transactions. The latter notably implies that VAT cannot be applied to the net income from transactions between Home and Abroad operators, as current practice in some countries.

Country of originating SIM card	Location of originating SIM card	Location of receiving SIM card	Type of call	VAT treatment
Home	Home	Home	Base case	• Originating Home SIM pays VAT • The caller's operator pays a VAT to the receiver's operator and credits it as input VAT
Home	Home	Abroad	Outgoing	• Originating Home SIM pays VAT • Home operator pays access fee to foreign operator (import of service) and reverse charges the VAT (charges the VAT to itself and remits it to Home tax authorities) at Home rate. This input VAT can be credited
Home	Abroad	Home or Abroad	Outgoing roaming	• Although the service is consumed Abroad, it is deemed consumed at Home, because the call is from a Home SIM card. Home VAT therefore applies • Home operator pays access fee to foreign operator (import of service) and reverse charges the VAT (charges the VAT to itself and remits it to Home tax authorities) at Home rate. This input VAT can be credited
Abroad	Home	Home or Abroad	Incoming roaming	• Although the service is consumed at Home, it is deemed consumed Abroad, because the call is from an Abroad SIM card. • The foreign operator pays an access fee to the Home operator, who exports a service, and the transaction is zero-rated
Abroad	Abroad	Home	Incoming	• The Home receiver does not pay the VAT
Abroad	Abroad	Abroad	NA	• NA

* See: Council Implementing Regulation (EU) No 1042/2013 of 7 October 2013 amending Implementing Regulation (EU) No 282/2011 as regards the place of supply of services. See also: OECD (2017), International VAT/GST Guidelines, OECD Publishing, Paris.

G. Input Taxes and User Fees

Like the excises discussed above, countries sometimes levy charges on telecom inputs to try to capture a share of sectoral profits. This practice is highly variable across countries and mainly takes the form of elevated customs duties on telecoms capital equipment and/or user fees on public inputs. Examples of the latter include charges for use of public infrastructure (e.g., trunk networks) or land (e.g., for antennas), issuance and management of phone numbers, and industry monitoring (minute counts).

It is economically efficient to charge for the cost of public services whenever the cost of the service can be calculated with reasonable accuracy and an exclusive user can be identified. This is clearly the case for many regulatory services, including those mentioned above. However, to the extent that fees exceed the cost of providing a service, they comprise an input tax. In many cases regarding telecoms, the service provided by public authorities is ill-defined or even non-existent, or its cost is overstated or reflects inefficient public service provision.[50]

Like consumer excises, input taxes have the potential to worsen the effects of limited competition. Katz and Rosen (1985) demonstrate using a Cournot oligopoly model that taxing inputs to a firm in an oligopolistic industry alters equilibrium prices, output and profits in a manner that may differ from that under perfect competition. If marginal costs are nondecreasing in the input tax—a reasonable assumption—then it will increase market prices and reduce output and, like for excises, the input tax can be overshifted to the consumer.

Since input taxes distort production and increase prices, they should be avoided in favor of more efficient types of taxes. Regulatory fees should be restricted to covering the cost of service provision.

H. Tax Incentives

Many governments offer telecom operators tax incentives that are also provided to other sectors, often through an investment code. The goal of such incentives is generally to attract foreign investment or to reallocate domestic investment towards specific economic sectors. Incentives may also be used to attract investment to geographic regions with low incomes or high unemployment. These incentives typically take the form of reduced taxes on profits (e.g., CIT holidays or reduced rates), investment (e.g., accelerated depreciation, expensing or investment tax credits) or inputs (e.g., customs duty waivers on capital goods and other inputs). Niger, for example, offered an initial 8-year holiday for CIT and some other taxes to four operators, and the Central African Republic has similar concessions.

Many of the business tax incentives offered in developing country investment codes are ill-advised, sacrificing scarce revenues on investment that would have taken place even without a

[50] Such inefficiencies might sometimes be related to the high level of unusual forms of remuneration and benefits in independent government agencies, especially if governmental oversight of these agencies is loose and if they are allowed to fund themselves through license and fees. Public agencies might also use fees to finance their own forays into activities that could more efficiently be provided by private or non-profit entities.

special incentive (IMF et al., 2015). Typical investment incentives include tax holidays or reduced CIT rate, accelerated depreciation or expensing, and customs waivers on imported inputs. As discussed in the previous section, customs waivers on capital goods can be justified in the name of productive efficiency, but a preferable policy is to specify a zero tariff on capital goods in the customs code in order to minimize discretion.

Extending investment incentives to the telecom sector is difficult to justify, given that telecom operator licenses confer exclusive rights to exploit "locational rents" from selling services into the domestic market. Incentives are sometimes necessary to attract foreign direct investment in export industries that depend on cheap inputs elastically supplied by various competing jurisdictions. Tapping this market necessarily requires a local presence to build the necessary infrastructure. Telecom companies therefore should not need special incentives to enter a country and should be excluded from any incentive scheme, since telecom tax breaks would likely result in revenue losses with minimal impact on investment. The existence of network externalities may, however, justify lenient terms for establishing networks in new areas. This was seen in many countries when initial cellular licenses were granted at no charge.

Since telecommunications is not a labor-intensive industry,[51] it is arguably not an appropriate candidate for incentives aimed at boosting regional employment. Host country governments do, however, have an interest in ensuring telecoms coverage in remote, thinly populated regions, which are not profitable for telecoms companies to cover. Approaches to ensuring this coverage vary across countries, encompassing methods such as "buildout" requirements in operator licenses and universal service funds. As in developed countries, these methods usually involve an operator's cross-subsidizing rural service provision from high-margin urban service provision, rather than a net government tax break or subsidy.

IV. Conclusion: A Pecking-Order Approach to Taxing Telecoms

Taxes on the telecoms sector have proliferated over the past decade, becoming a source of considerable uncertainty and compliance costs. These include elevated customs duties on capital equipment and handsets, diverse regulatory fees, elevated CIT and VAT rates, and telephone call excises. Heavy taxation of the telecom sector has arisen from several factors, including perceived high profit levels, the large size and formality of the sector, the difficulties of spectrum valuation and MNE income taxation, and "claw-back" of initially over-generous concessions.

A major goal of this paper is to disentangle sound and unsound rationales for sector-specific telecom taxation by returning to the fundamental economic characteristics of telecoms. It concludes that where rents from limited competition cannot be addressed through regulatory measures, they may justify a higher level of taxation. However, many of the fiscal instruments applied to telecoms do not target rents well and moreover distort product and output markets, impeding efficiency, affordability and growth. The capacity of different taxes to target rents

[51] Antennas are often accompanied by a power generator and a few guards to keep an eye on the infrastructure and fuel.

points to a "pecking order" of tax instruments, whose principle is to rely on taxes that best capture rent and to resort to tax measures that affect consumer prices only as a fall-back option.

Auctions, which have the capacity to capture rents without distorting investment and prices, are a favored option, particularly for middle- and high-income countries with the regulatory capacity to design and implement them effectively. However, auctions are not a panacea. Because they are based on expected rents, which will likely prove lower or higher than actual rents, they may either leave the operator with a windfall or strain its financial position. Collusion or governance issues around the auction process can also affect auction prices and result in under-taxation of rents. Auctions are also impossible where a country's spectrum licenses have already been awarded for long periods. Furthermore, the primary goal of licensing is not to maximize government revenue but to allocate licenses to the most efficient providers; overemphasis on revenue generation can create perverse incentive for regulators to encourage monopolistic behavior.[52]

Alternative options for targeting rents are a rent tax or CIT surcharge. Like auctions, these instruments capture a portion of telecom rents with minimal impact on communications prices. They are both more equitable and flexible than auctions in that they are based on actual rather than expected profits. However, they share a common weakness in being subject to earnings manipulation and transfer pricing, which is of greatest concern in low-capacity countries. There are also important differences between a rent tax and a CIT which may make one or the other more appropriate in a given context: Because the CIT applies to normal profits as well as rent, it raises the cost of capital, which reduces investment and could increase output prices. Conversely, rents taxes generally lead to greater revenue deferral, and the administrative cost of implementing an additional profit-based tax may be quite large.

A last line of defense is taxes on consumption of telecom services. Service excises are an imperfect instrument to capture economic rents, and they raise prices and therefore restrict network access, reducing consumer welfare and production efficiency. However, they are simple to design and administer, difficult for telecom companies to avoid, and they generate revenues as soon as services are provided. If an excise must be used, ad valorem excises are preferable to specific excises because they are less likely to be over-shifted to consumers. A VAT surcharge may be preferable to an ad valorem excise, since it does not burden formal businesses, though it may necessitate a higher rate on consumers and complicate administration. Excises on handsets and initial connection, which specifically burden network access, should be avoided to protect the positive externalities from network expansion.

Given the availability of consumer-level excises, taxes on producer inputs (including customs duties and excessive public user fees) should in all cases be avoided, as they do not effectively target rents (and may even increase them) while distorting both consumer and producer markets. Conversely, tax incentives should also be avoided as unnecessary to attract investment to exploit the local consumer market. Aside from these considerations, all taxes should be the same as for other sectors.

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[52] Auriol and Warlters (2005)

This pecking order approach does not necessarily mean that a single tax instrument should be applied. As in the extractive industries, a balanced tax regime sharing fiscal and economic risks between investors and the government is advisable. Understanding how different tax instruments affect the cell phone industry should help governments better structure their approach and curb the current proliferation of telecom taxes and fees. Above all, however, the rapid evolution of the telecom sector demands caution in tax system design: Technological innovation has an unpredictable impact on market structure, which will require the tax system to adapt accordingly. The rapid pace of technological change in the telecom industry raises the questions of whether telecom rents will persist and to what companies they will accrue. The answer to these questions depends in large part on the extent to which country regulatory regimes and market dynamics encourage effective competition.

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